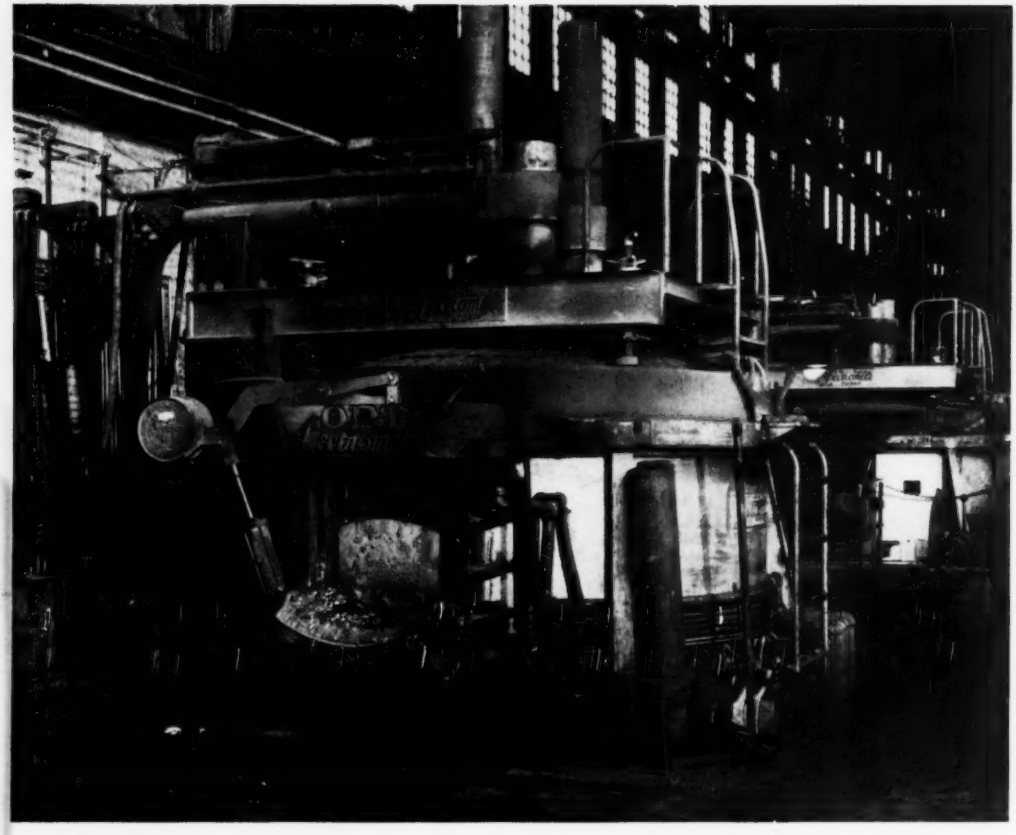
MARCH • 1949

# American Foundryman



THE FOUNDRYMEN'S *Own* MAGAZINE



Filling a large number of small, diversified orders profitably is one of the outstanding services offered by Moore Rapid Lectromelt Furnaces. The usual heat melted by the Lectromelt Furnace can have its analysis repeatedly changed, if desired, quickly and easily. Thus you can tap the heat to fill one order, alter the analysis, tap for another order and repeat this process until all the metal has been used. That turns small orders into profit.

Lectromelt Furnaces are available in capacities ranging from 250 pounds to 100 tons. Write today for complete information.

**PITTSBURGH 30, PENNSYLVANIA**

**MOORE RAPID**

**FURNACES**

**manufactured in: CANADA, Lectromelt Furnaces of Canada, Ltd., Toronto 2; ENGLAND, Birlec, Ltd., Birmingham; SWEDEN, Birlec Elektkougnar A/B, Stockholm; AUSTRALIA, Birlec Ltd., Sydney; FRANCE, Stein et Roubaix, Paris; BELGIUM, S. A. Belge Stein et Roubaix, Bressoux-Liege; SPAIN, General Electrica Espanola, Bilbao; ITALY, Forni Stein, Genoa.**

# CROWN HILL SEACOAL FACING

*Q.* Is there a difference in seacoals?

*A.* Yes.

*Q.* What makes the big difference?

*A.* Quality of the coal, amount of volatile content, plus care in manufacture of the product.

*Q.* Why do so many foundries use Crown Hill, made by Federal?

*A.* Crown Hill has quick combustibility, allowing gas and steam to escape fast. This speed of performance results in easy cleaning and helps cut down on defects, another easy way to shave your production costs. Try CROWN HILL SEACOAL FACING—

*Popular Choice of Foundrymen Everywhere*

FIGURES FROM BUREAU OF MINES
DEPT. OF INTERIOR OF THE U. S.
(Moisture Free)

PROXIMATE ANALYSIS

| | |
|---|---|
| Volatile Matter (V.C.M.) | 38.9 |
| Fixed Carbon | 57.4 |
| Ash | 3.7 |
| | 100.0 |

ULTIMATE ANALYSIS

| | |
|---|---|
| Hydrogen | 5.0 |
| Carbon | 82.0 |
| Nitrogen | 1.3 |
| Oxygen | 8.0 |
| Sulphur | .7 |
| Ash | 3.0 |
| | 100.0 |

Fusion Point of Ash . . . . . 2,950°F.

## THE FEDERAL FOUNDRY SUPPLY COMPANY

Seacoal Plant
CROWN HILL, W. VA. • CHICAGO • DETROIT • MILWAUKEE • RICHMOND, VA.
CHATTANOOGA, TENN. • NEW YORK • ST. LOUIS • Mines UPTON, WYO.

IN TWIN CITIES: The Foundry Supply Co., Inc.,
404 South Third St., Minneapolis 15, Minn.

4600 East 71st Street
Cleveland 5, Ohio

**THE FOUNDRYMEN'S *Own* MAGAZINE**

It's only natural for the foundry industry to look to the Official Publication for authoritative information relating to the 53rd Foundry Congress . . . St. Louis, May 2-5. Foundrymen want full details of the technical sessions, the round-table luncheons and special meetings — that's why they are waiting for the **April Pre-Convention Number** which will also carry Part One of the new Products Parade feature . . . a *Buyers' Guide* . . . Convention forecast and enlarged sections for inclusion of the latest and most reliable articles and news stories relating to the development and production of cast products . . . and a bigger advertising section. The **May Post-Convention Issue** will carry a full report of Convention highlights, plus the second installment of Products Parade, "the exhibit on paper" . . . *Buyers' Guide* . . . expanded advertising and editorial features.

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**222 West Adams Street, Chicago**

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MARCH, 1949

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VOLUME XV, NUMBER 3

# American Foundryman

March, 1949

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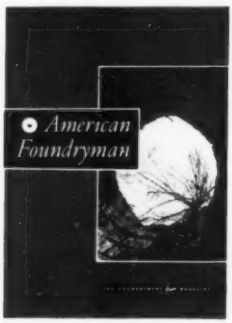



*The American Foundrymen's Society is not responsible for statements or opinions advanced by authors of papers printed in its publication.*


### This Month's Cover

Looking skyward from the bottom of a long unused charcoal blast furnace still standing in the "Hanging Rock District" of southern Ohio. Able to produce as high as 20 tons of iron a day, such furnaces were operated on low grade ores and limestone available nearby. Furnaces of this type and earlier colonial furnaces are described in Bruce L. Simpson's DEVELOPMENT OF THE METAL CASTINGS INDUSTRY, recently named one of the 50 best books of 1948 in a field of over 10,000 entries (see page 40). Photo by Bradley H. Booth, Carpenter Bros., Inc., Milwaukee.


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# HERE IT IS!

*and*

*The*

## MELTING FURNACE THAT IS REVOLUTIONIZING DIE CASTING!

## ...THE *LINDBERG-Fisher* 2-CHAMBER MELTING FURNACE

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

**DOUBLE CHAMBER** permits charging cold metal without disturbing temperature conditions in ladling or pouring chamber. This eliminates need for special melting furnaces and handling of hot metal thru the shops.

**DOUBLE CHAMBER** construction confines impurities in charging chamber—only clean metal is allowed to pass into pouring chamber.

**DOUBLE CHAMBER** permits melting down in case of freeze up.

**AUTOMATIC TEMPERATURE CONTROL** is amazingly precise. Metal is held at lowest possible temperature insuring sound castings, long die life and maximum number of shots per hour.

**CAST "MARVEX"* LINING,** "Like wine it seems to get better as it gets older". We don't know what life to expect—definitely more than a year and probably three or four, and it's as easy to replace as pouring a plaster cast. Furthermore, the channels can be replaced without relining the entire furnace.

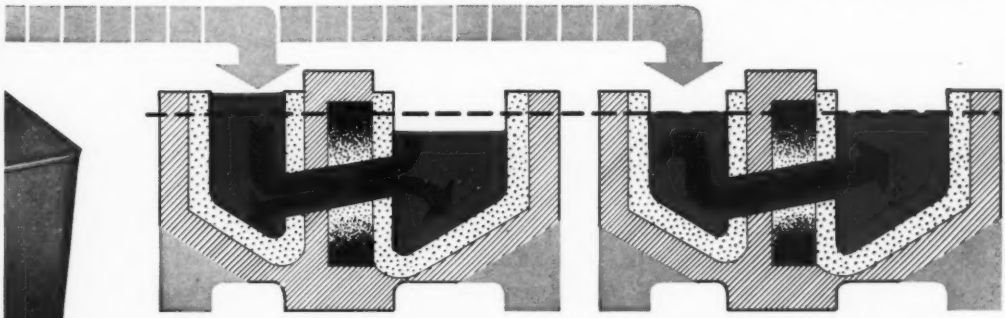
**WORKING CONDITIONS** are improved immensely which means more production, happier operators.

**GENTLE MAGNETIC FLUXING** assures clean, homogenious metal.

**METAL LOSSES REDUCED** to a minimum because the metal is heated from the inside out. Therefore, only coldest part of metal is exposed, and this only to clean, dry air.

**Copyright 1949 Lindberg Engineering Company.*

# HERE'S HOW IT WORKS!



**POWER ON** — Positioning of primary coil in relation to channels forces a greater amount of hot metal into one chamber.

**POWER OFF** — When power is interrupted, metal flushes thru the channels, cleansing them, as in exaggerated illustrations above.

## NEW... PATENTED FEATURES DISCLOSED HERE FOR THE FIRST TIME!

**CHANNEL FLUSHING***, *a new development which eliminates the worry of channel clogging.*

The primary coil of the furnace is so positioned in relation to the channels as to cause a greater amount of hot metal to be forced into one chamber than the other. This causes a higher level of metal to exist in the one chamber which is released when power is shut off, resulting in a rush of metal thru the channels to the opposite chamber. When the power is restored, the metal flushes back thru the channels again in the opposite direction. The control equipment includes means for interrupting the power circuit once a minute so the "*Channel Flushing*"* occurs twice each minute—once in each direction. The important flushing is the one at the "power off" period when dross and impurities are released from the magnetic field at the "pinch" location.

**"CHANNEL FLUSHING"*** accomplishes another vital job. By pumping more hot metal into the charging chamber, more BTU's are supplied there to melt the cold metal being charged. It is of course impossible to precisely allocate the exact amount of heat to each of the two chambers *but* the constant flushing of the metal between chambers evens out all irregularities of temperature distribution. Constant mixing and stirring also insures uniform metal analysis and provides desirable fluxing action.

**Patents Pending*

**Ask for reprint of magazine article "Two Chamber Induction Furnace Lowers Aluminum Die Casting Cost". The writer of that paper, Mr. Floyd J. Kamin, Kamin Die Casting & Manufacturing Co., received the FIRST PRIZE ($1000.00) in the Industrial Furnace Manufacturers Association contest for the best technical article appearing in a trade publication describing methods to increase production, improve quality and reduce cost by the use of modern industrial furnaces.**

# LINDBERG-Fisher MELTING FURNACES

**A DIVISION OF LINDBERG ENGINEERING COMPANY**

**2440 West Hubbard Street, Chicago 12, Illinois**

# Dallett Pneumatic Vibrators

## *Precision Built to Meet Your Foundry Needs*

DALLETT Pneumatic Vibrators are valveless, simple in design, but sturdy in construction. They are engineered for dependability, long life and top performance.

They are made in two series, the "MPV" for Match Plate Foundry work, and the "M" Series for heavy forms, loading hoppers, dust arrestors and for many other heavy duty requirements.

Illustrated is the Dallett "MPV"—7. This series is available in four sizes.

### *Only One Moving Part*

Both Series of Dallett Pneumatic Vibrators have *but one moving part —the piston.* There are no springs to be replaced. Dallett's springless construction means less breakdowns for you, saves costly replacement time and money.

### Trouble-free Construction *Means More Production*

Smooth operation and high efficiency are assured in all Dallett Vibrators because of their *precision* construction. All barrels and pistons are carefully heat treated and precision ground. Standardize on Dallett Pneumatic Vibrators for maximum performance.

### Send for Bulletin 100

This bulletin fully describes and illustrates Dallett's Line of Pneumatic Tools. For Dallett Forged Products ask for Bulletin #200. Complete Airline Accessories are covered by Bulletin #300.

TOOL MAKERS
PNEUMATIC DALLETT EQUIPMENT ACCESSORIES
SINCE 1883

**THE DALLETT COMPANY**

MASCHER AT LIPPINCOTT STREET, PHILADELPHIA 33, PA.

**Manufacturers of Pneumatic Tools and Accessories**

DISTRIBUTORS in principal cities throughout the United States, Canada, Europe and South America.

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Producers of aluminum alloy ingot and deoxidizing shapes to exact specifications . . . the USCO trade mark is your assurance of quality backed by over 40 years of experience.

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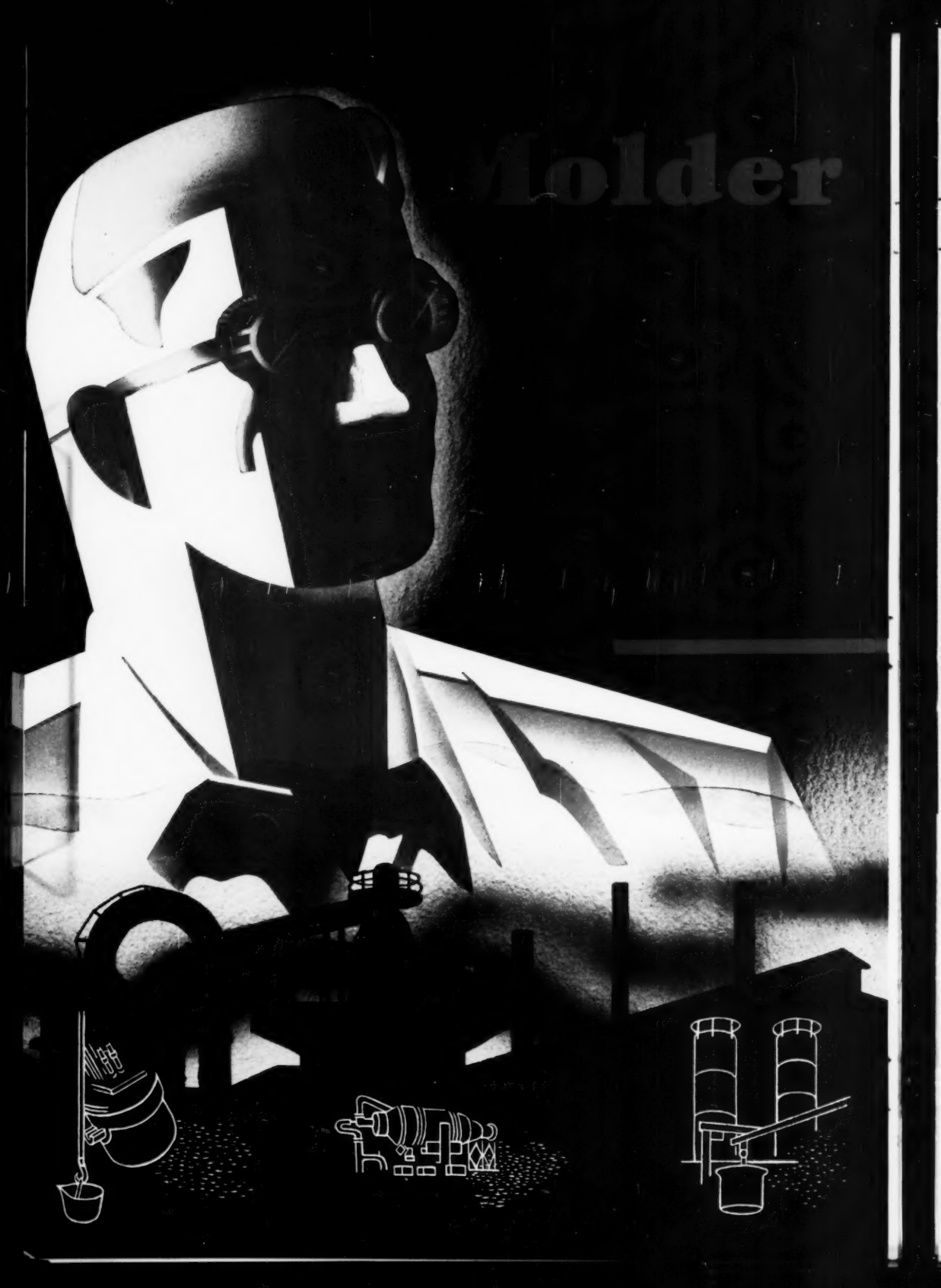
Molder

# of Night

Imagine an America without fine motor cars — streamlined trains — giant planes! Imagine an American way of life where ordinary conveniences like refrigerators, ranges and radios would be rare luxuries. Such would be our life were it not for you, the foundryman. The sinews of America's strength are formed of your fibres. You've a right to be proud of your job which is contributing so much to our welfare and well-being!

# THIEM

Thiem Products, Inc. takes pride in serving you and your industry. Through its laboratory-controlled core-washes and mold-coatings, Thiem offers products that are unquestioned in quality, unmatched in utility. Through scientific research and development, Thiem constantly seeks new products and new ways to further your progress.

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***Manufacturers of Foundry Products Exclusively***

**KROME KOTE • FERRO KOTE • MOLD LITE • INGOT KOTE • NODRI MOLD SPRAY • FERRO-GLAZE FLUX • CHILL KOTE • SYNOL • CORE BINDERS**

Visit us in St. Louis — May 2 - 5. American Foundrymen's Society 53rd Annual Convention. Headquarters — De Soto Hotel.

# An Heritage of skill in a craft

Peter Vischer, the great bronze founder, was a Fifteenth Century Guild Master and responsible for some of the most artistic castings that are today looked upon as examples of all time expert design and workmanship.

As a boy Peter worked as an apprentice with his father. In those days every youth destined for a certain trade had to be apprenticed to a Master who was responsible for his education.

This tradition has been carried on through the centuries—and today in our own plant we have many sons working along side of their experienced fathers. As an example, here is an illustration of Master Craftsman Ben Szymanski and his well-taught and equally accomplished son George B. Szymanski.

**PETER VISCHER**
*The Craftsman*
St. Sebald's Church
Nürnberg

PERMANENT MOLDS · WOOD AND METAL PATTERNS · KELLER AND DUPLICATOR WORK · MACHINE WORK · MALLORY METALS BERYLLIUM COPPER · MONEL METAL · EVERDUR CASTINGS COPPER CASTINGS OF HIGHEST ELECTRICAL CONDUCTIVITY · BRASS, BRONZE AND ALUMINUM CASTINGS

**CITY PATTERN**
FOUNDRY AND MACHINE CO.

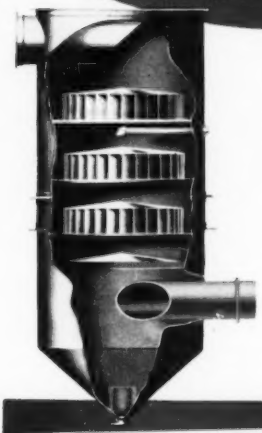
**1161 HARPER AT RIVARD · DETROIT 11, MICHIGAN**

# "SW" WET METHOD CUPOLA

*Creates*

# "GOOD NEIGHBOR" POLICY

**MELTING DEPARTMENT**
*Smoke and Dust*
**NUISANCE GONE**



**You gain two valuable advantages by installing a Schneible System in your foundry. By removing the fly-ash nuisance from the plant premises and neighborhood, you save clean-up work and deterioration of roofs, gutters and other facilities. The foundry is a much better "Neighbor" in the community!**

**The cupola fly-ash is collected as a sludge in the re-circulating tank so that it can be removed from the plant instead of becoming a nuisance.**

**The same water that collects this fly-ash can be used to quench the slag and sluice it back to the re-circulating tank for disposal in the same manner.**

**In addition a small Multi-Wash Collector can also be used for the collecting and removal of slag wool from behind the cupolas.**

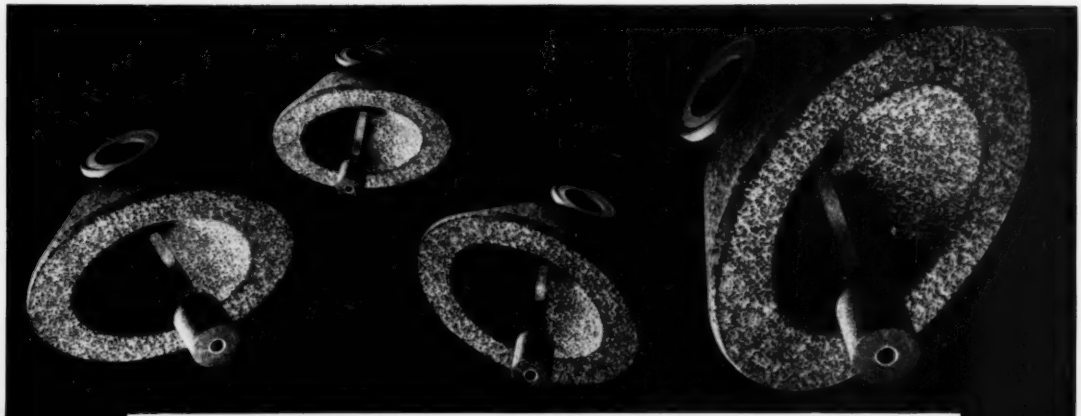
**Easy to operate. Efficient. Minimum maintenance.**
**(U.S. and Foreign patents applied for.)**

*Free*

Check into the substantial savings possible in your plant. Write for a copy of "Schneible in the Foundry Industry"—Bulletin No. 47.

**CLAUDE B. SCHNEIBLE COMPANY**
**2827 Twenty-Fifth Street • Detroit 16, Mich.**

# SCHNEIBLE



# Now! Peninsular announces custom-tailored vitrified wheels!

***Peninsular*** announces the addition of vitrified bonded wheels to its present line of superior resinoid bonded wheels.

***These*** vitrified wheels offer the same custom-tailored precision as the Peninsular resinoid line. They are available in a variety of sizes and shapes to meet most of your grinding needs. Continued expansion and development of the vitrified line will assure individualized engineering attention for many of your grinding operations.

This news may be the best of the year if you're glum because of high grinding expenses. Peninsular's new vitrified wheels and "tailored-for-the-job" service may be able to help you cut down dressing costs, give you longer wheel life and higher stock removal. *Why not call on Peninsular engineers to plot a new grinding course for you?*

They'll examine everything about your grinding operations—the machinery used, the materials ground, and the finishes required. After a complete study of their findings, Peninsular develops and recommends wheels specifically designed to fill your needs.

***Peninsular*** has brought the good news of lower grinding costs to manufacturers in over fifty diversified fields.

Why not get good grinding news for yourself this year by calling on our Peninsular consultants?

**The Peninsular Grinding Wheel Co.,** 729 Meldrum Ave., Detroit 7. Sales Offices: Chicago, Philadelphia, Buffalo, Cleveland, Pittsburgh, Houston, St. Louis, Cincinnati.

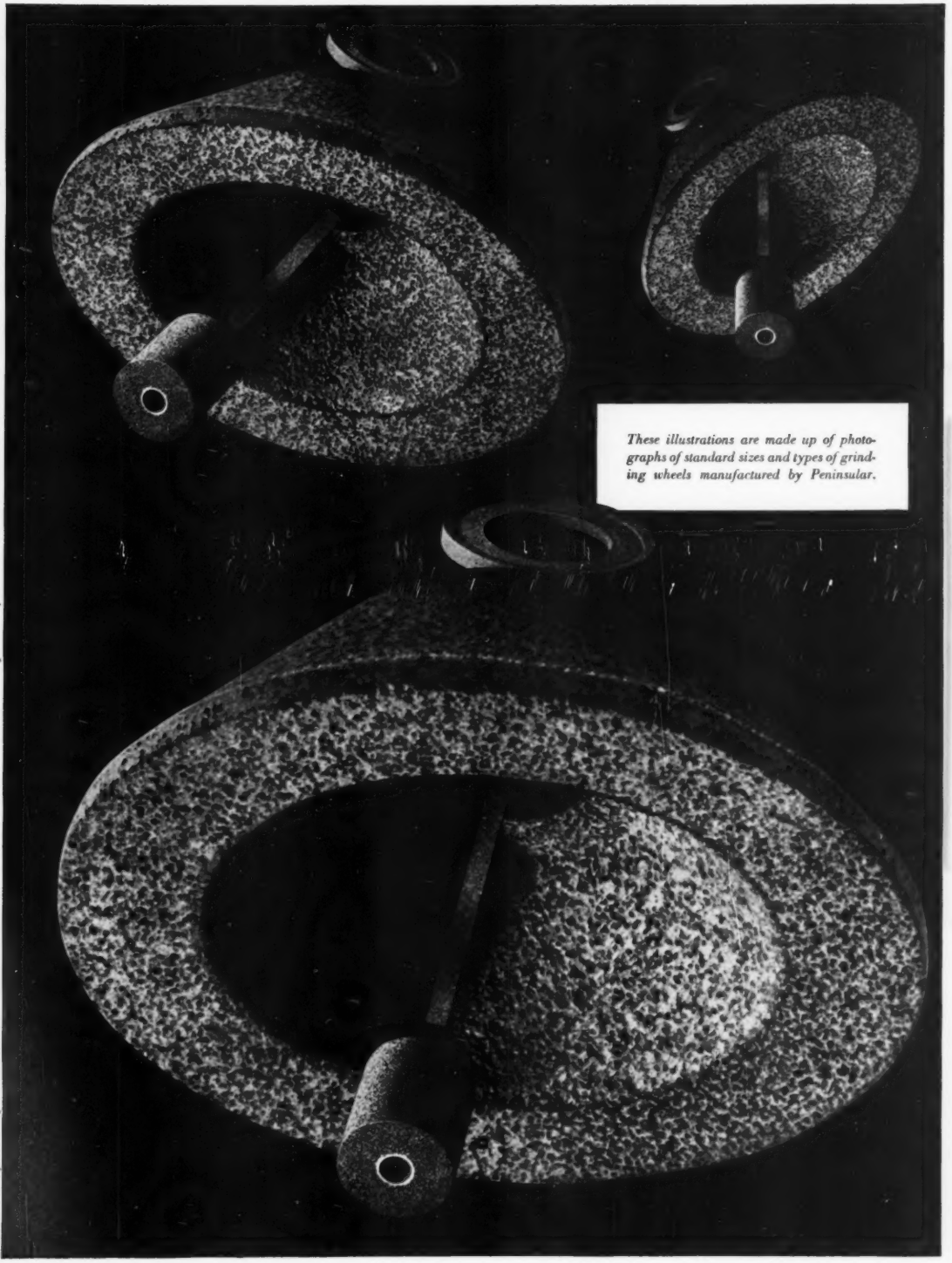
# PENINSULAR

*INDIVIDUALLY* PENINSULAR *ENGINEERED*

## GRINDING WHEELS

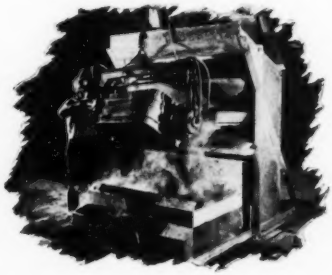
*SINCE 1889*

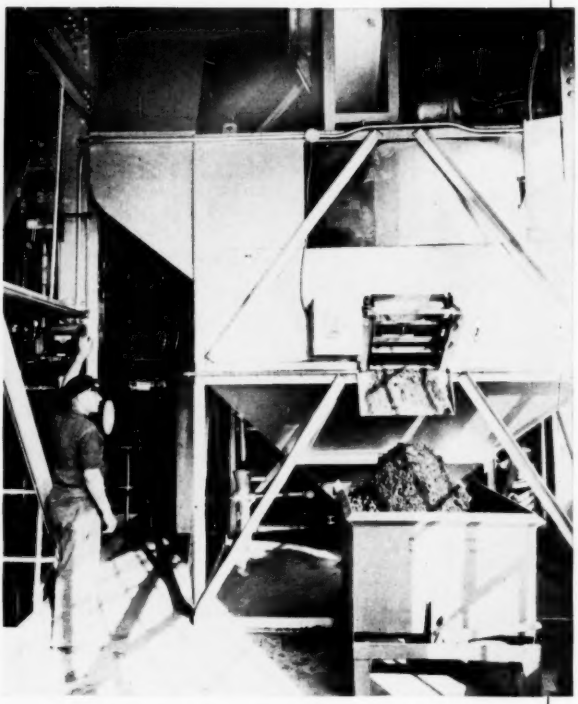
SPECIALISTS IN RESINOID AND VITRIFIED BONDED WHEELS



*These illustrations are made up of photographs of standard sizes and types of grinding wheels manufactured by Peninsular.*

# The sludge tells the story of ROTO-CLONE'S efficient dust control





• *Fine dust collected by Type W Roto-Clone from shakeout is discharged as a mud-like sludge for easy disposal*

• *Bulletin No. 274-A—gives the complete story about Type W Roto-Clone design and operation. It's free—write for a copy now!*

MINUTES ago the sludge shown at left consisted of millions of free fine dust particles of small micron size. They were released during the operation of the Link Belt 3x5 Shakeout pictured above. But before this dust could foul up the atmosphere, it was snapped up by the side-hood exhaust of a Type W Roto-Clone* (Arrangement C) and transformed into a harmless, easily disposed sludge.

The Type W Roto-Clone and AAF Shakeout Side-Hood combine all the features of complete dust control—confinement at the source, effective exhaust, high efficiency collection and discharge of consolidated sludge without creating a secondary dust problem. The Type W is a wet-type collector, combining water sprays and dynamic precipitation. Operation requires little water and no recirculating equipment.

Dust from shakeouts, sand conditioners and grinders; smoke and fumes from electric furnaces — all can be controlled effectively and economically with one of the many types of Roto-Clone equipment.

Write today for complete information or call your local AAF representative.

**AMERICAN AIR FILTER COMPANY, INC.**
**104 Central Avenue, Louisville 8, Ky.**
***In Canada: Darling Bros., Ltd., Montreal, P. Q.***

®AAF

**ROTO-CLONE®**
**DUST CONTROL EQUIPMENT**

*Roto-Clone is the trade-mark (Reg. U.S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.

# CORE TROUBLES?

## 4 WAYS TO GET BETTER RESULTS—USE KRAUSE CEREAL BINDERS

Yes—the qualities you need and want are yours in Krause's Cereal Binders—TRUSCOR (light weight) and AMERIKOR (heavy weight).

So why not take advantage of all these benefits by placing your next order with any of the distributors listed below or with us direct.

CHAS. A. KRAUSE MILLING CO., Milwaukee 1, Wisconsin

*World's largest dry corn millers.*

## CEREAL BINDERS

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Shake-outs have long been the dustiest, dirtiest section of a foundry. Not so in this modern plant. Kirk & Blum installed these efficient "over-and-under" hoods which collect dust as it is released in the shake-out operation. In the photo above, six of the shake-out stations are seen. Piping is designed to meet AFA standards; note the cleanout doors and gasketed companion angle connections.

This installation is one of a number in the modern southern foundry of one of the world's largest farm implement makers. In other parts of the plant are KIRK & BLUM Systems which remove fumes, dust and chips from various operations.

From this and thousands of other installations in widely varying industries, KIRK & BLUM has gained great skill and knowledge, based on 40 years experience. This experience is at your service. Write for booklet, "Dust Collecting Systems in Metal Industries." The Kirk & Blum Mfg. Co., 2876 Spring Grove Ave., Cincinnati 25, Ohio.

FOR CLEAN AIR . . . THE INVISIBLE TOOL KIRK AND BLUM DUST CONTROL SYSTEMS

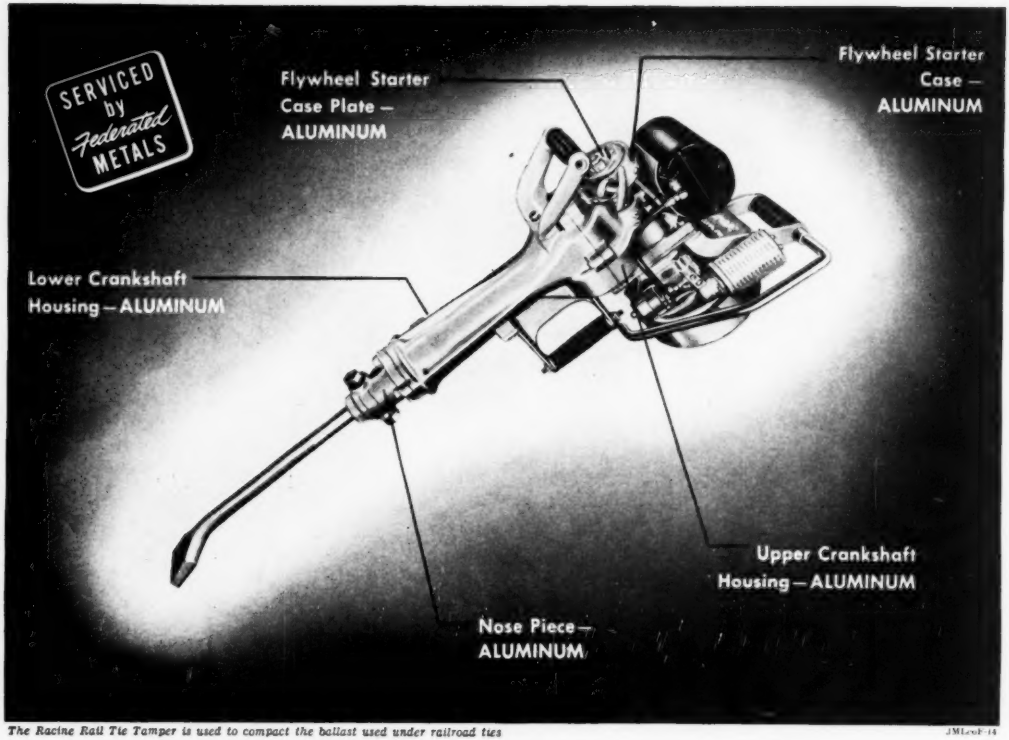
# A BULL'S-EYE
## the first time and every time with

## UNIVERSAL FLASK PINS and BUSHINGS for cope and drag

Cope and drag alignment troubles are a thing of the past once you install Universal precision made standardized Flask Pins and Bushings. When Universal closing pins are used, *valuable production time is saved on each operation* because Cope Bushings are quickly guided to the Drag Pins. Universal Flask Pins and Bushings are hardened and ground for *maximum resistance to wear,* adding greatly to their productive life. Design permits longitudinal expansion to compensate for metal heat, without affecting accurate alignment. Universal Flask Pins and Bushings are made in standard sizes and shapes. Special types and sizes to order. *Write for illustrated folder.*

**UNIVERSAL ENGINEERING COMPANY**

**FRANKENMUTH 12, MICHIGAN**


SERVICED by Federated METALS
Flywheel Starter Case Plate — ALUMINUM
Flywheel Starter Case — ALUMINUM
Lower Crankshaft Housing — ALUMINUM
Upper Crankshaft Housing — ALUMINUM
Nose Piece — ALUMINUM

*The Racine Rail Tie Tamper is used to compact the ballast used under railroad ties*

JMLcoF-14

# HOW ALUMINUM SAVES MANPOWER

To reduce operator fatigue and increase efficiency, the Racine Tool & Machine Company, of Racine, Wisconsin, had to cut weight on their Rail Tie Tamper. Three years of testing brought them to the use of a Federated aluminum alloy in casting several important tool parts.

The problem of alloy choice was difficult because the terrific pounding received by the tool required an alloy of *high impact strength, high yield strength,* and a *high proportional limit.*

Three years of experiment and test by Racine engineers and Federated metallurgists produced the desired results. Federated aluminum alloy F-430, heat treated, is used for the parts of the tool highlighted above. Tool weight is down . . . performance is up . . . operator fatigue is reduced.

The complete metallurgical and service facilities of Federated are at YOUR command, too. See Federated for the first in service and the first in products—copper-base alloys, aluminum and magnesium alloys, bearing metals, solders, die casting alloys and fabricated lead products. 24 sales offices across the nation.

Federated first in the non-ferrous field AMD

Federated METALS

**Division of American Smelting and Refining Company, 120 Broadway, New York 5, N.Y.**

# *The Investment of a*
# FRACTION
## OF A CENT PER AVERAGE SIZE CASTING
## *Pays Off--Amazingly!*

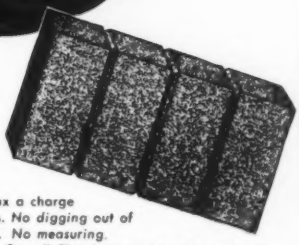
● **HERE'S WHAT YOU GET in return for using a little Famous Cornell Cupola Flux with every charge of iron:**

- **CLEAN MOLTEN METAL.**
- **HOTTER, FREER FLOWING METAL.**
- **BIG REDUCTION OF SULPHUR.**
- **SOUNDER, TOUGHER CASTINGS WITH MORE EVEN GRAIN.**
- **EASIER, SMOOTHER MACHINING.**
- **REDUCTION OF COSTLY REJECTS.**
- **CLEANER CUPOLAS, CLEANER DROPS.**
- **LONGER LASTING CUPOLA LINING.**
- **GREATLY REDUCED CUPOLA MAINTENANCE TIME AND LABOR.**

**MALLEABLE FOUNDRIES,** with cupola operation, are showing a rapid trend towards the use of Famous Cornell Cupola Flux. Reports of greatly improved casting production come from every direction. Furthermore, there is a considerable reduction in cupola maintenance labor and cost. The life of cupola lining, whether brick or stone, is greatly prolonged.

*Famous* CORNELL CUPOLA FLUX

**SCORED BRICK FORM Saves Labor**



With Famous Cornell Cupola Flux, you can flux a charge of iron in a few seconds. *No digging out of container. No weighing. No measuring.* You simply toss Famous Cornell Flux into cupola with each ton charge of iron or break off one to three briquettes (quarter sections) for smaller charges.

Flux in this form does not blow out with the blast but STAYS in melting zone until entirely consumed, insuring fullest efficiency.

WRITE FOR BULLETIN 46-B

## *The* CLEVELAND FLUX *Company*

**1026-1034 MAIN AVENUE, N. W., CLEVELAND 13, OHIO**

*Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes — Since 1918.*

FAMOUS FLUXES Trade Mark Registered

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| *Famous* CORNELL ALUMINUM FLUX | *Famous* CORNELL BRASS FLUX | *Famous* CORNELL LADLE FLUX |
|---|---|---|
| Produces clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections are poured. Castings take a higher polish. NO FUMES! Exclusive formula prevents obnoxious gases. Metal does not cling to dross. | Makes metal pure and clean, even when dirtiest brass turnings or sweepings are used. Produces castings which withstand high pressure tests and take a beautiful finish. Saves considerable tin and other expensive metals. Crucible and furnace linings are preserved. | Place a few ounces in bottom of ladle, then tap cupola. Metal is thoroughly cleansed, foreign impurities are easily skimmed off. Ladles are kept clean, there is less patching and increased ladle life. Metal temperatures are retained during transfer to molds. |

# FERROCARBO Briquettes

TRADE MARK

**Fluidity Spiral of white iron made by the duplex cupola-air furnace process utilizing FERROCARBO briquettes. Notice the unusual length of this spiral and the even fracture of the gate.**

**FERROCARBO briquettes** are proving particularly effective in producing consistently prolonged metal fluidity. A number of fluidity spirals of white iron made by the duplex cupola-air furnace process, with FERROCARBO briquettes in the charge, confirm this fact. The one that is illustrated is a typical example.

Plant records, showing a substantial reduction in misruns, shrinks and hot tears, add further proof that hotter, more fluid iron is being produced with FERROCARBO briquettes in the charge.

Other advantages are also provided by this new development in duplex malleable iron melting. For a more thorough and detailed understanding, we suggest a discussion with our metallurgical staff at your earliest convenience.

## FERROCARBO Briquettes
### BY CARBORUNDUM
TRADE MARK

**THE CARBORUNDUM COMPANY, Abrasive Grain and FERROCARBO Division, Niagara Falls, New York**

FERROCARBO Distributors: Ketchner, Marshall & Co., Pittsburgh, Cleveland, Birmingham, Philadelphia and Buffalo; Miller and Company, Chicago, St. Louis and Cincinnati

*"Carborundum" and "Ferrocarbo" are registered trademarks which indicate manufacture by The Carborundum Company*

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*Apex intense search—and research—for improved alloys give you the quality Alloys That Are Best By Test—from Ingot to Casting.*

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# "ELECTROMET" TUNGSTEN

Trade-Mark

## STRENGTH-BUILDER FOR THE HIGH-TEMPERATURE SUPER-ALLOYS

### TYPICAL APPLICATIONS OF HIGH-TEMPERATURE ALLOYS

*BLADES FOR JET ENGINES*

*TAIL CONES FOR JET ENGINES*

*GAS TURBINE SHAFT, DISK AND BLADES*

What does it take to make a super-alloy?

Most of the so-called "super-alloys" that have been created for high-temperature service are made up of several metals so that it is almost impossible to say which should get most credit for each of the desirable properties that the alloys have. Many contain tungsten, which increases the hardness and the strength of the alloys at high temperatures. Creep strength shows improvement, too.

The percentage of tungsten in these high-temperature alloys depends upon the physical properties desired and the service temperatures to be met. All of the alloys can be readily cast and some can be forged and rolled without difficulty. Some typical applications in gas engines are rotors, exhaust stacks, tail cones, and turbine blading.

For the manufacture of high-temperature alloys, "Electromet" supplies a high-quality ferro-tungsten conforming to A.S.T.M. Specification A144-39. This ferro-alloy contains 70 to 80 per cent tungsten and a maximum of 0.60 per cent carbon. It is available for immediate delivery in a crushed size of ¼ inch by down which is suitable for all electric furnace additions.

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# Mexaloy Super Refractory Saves Linings and Equipment

**Tough, non-fusible protective lining for ladles, spouts, runners and cupolas**

Mexaloy is the ideal material for protecting refractory linings of cupolas, ladles, runners and spouts in both foundries and steel plants. Mexaloy makes the body containing it highly resistant to sudden, violent temperature changes and thus avoids spalling and cracking of the refractory. Practically infusible, it will not melt or change its character under the action of molten metal. Neutral and chemically inert, Mexaloy's presence insures resistance to fluxing and corrosive action by molten metals and slags. It provides a low-friction, surface which allows no foreign body adherence.

Mexaloy is extremely easy to apply. Mixed with clay, ground fire brick and water according to a simple formula, the resulting mixture is easily applied by tamping. Linings containing Mexaloy last longer. For example, in the spouts of open Hearth furnaces where the usual loom layer has to be replaced after every one or two heats Mexaloy linings invariably last more than 10 heats—sometimes as many as 30. In Foundry cupolas Mexaloy linings last longer and improve metal quality.

To greatly reduce "shut downs" in your steel plant or foundry due to refractory replacements, it will pay you to use Mexaloy. Write today for further information.

# Mexaloy

**THE UNITED STATES GRAPHITE COMPANY • SAGINAW, MICHIGAN**

**DIVISION OF THE WICKES CORPORATION**

# LESS HORSEPOWER REQUIRED with SIMPSON MIXERS

Obviously, the lower horsepower required to do an efficient, thorough sand preparing job, the lower the cost—for power and for maintenance. In Simpson Intensive Mixers, you are assured of the lowest horsepower per ton of properly prepared sand . . . made possible by these engineering features:

In the Simpson, sand lies upon a stationary pan, power being required only for working the sand—by rolling the mullers over the sand which the plows have windrowed into the muller path.

Second, the well-balanced design and precision workmanship of all moving parts reduces friction, which reduces heat, thus requires less horsepower.

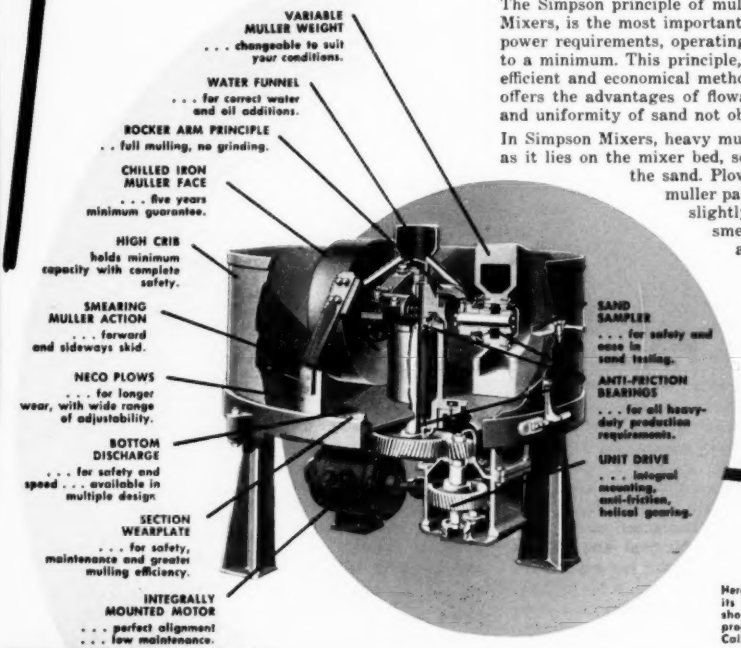
Listed below are some of the advanced engineering features responsible for the dependable, long-life operation of Simpson Mixers in all classes of foundries, on the toughest sand preparation problems.

## The Simpson Principle of Mulling

The Simpson principle of mulling, as effected in Simpson Mixers, is the most important factor in holding horsepower requirements, operating costs, and maintenance to a minimum. This principle, which provides the most efficient and economical method of preparing molding sand, offers the advantages of flowability, toughness, elasticity and uniformity of sand not obtained by any other method.

In Simpson Mixers, heavy muller wheels roll over the sand as it lies on the mixer bed, squeezing and kneading the sand. Plows then repile the sand in the muller path. Because the mullers are set slightly off the true radius, the smearing action is intensified . . . and only the Simpson employs this true mulling principle.

In the Simpson design, the mullers never approach closer to the bedplate than the diameter of at least ten sand grains . . . thus, there is no possibility of any crushing or grinding action.


VARIABLE MULLER WEIGHT
. . . changeable to suit your conditions.
WATER FUNNEL
. . . for correct water and oil additions.
ROCKER ARM PRINCIPLE
. . full mulling, no grinding.
CHILLED IRON MULLER FACE
. . . five years minimum guarantee.
HIGH CRIB
holds minimum capacity with complete safety.
SMEARING MULLER ACTION
. . . forward and sideways skid.
NECO PLOWS
. . . for longer wear, with wide range of adjustability.
BOTTOM DISCHARGE
. . . for safety and speed . . . available in multiple design
SECTION WEARPLATE
. . . for safety, maintenance and greater mulling efficiency.
INTEGRALLY MOUNTED MOTOR
. . . perfect alignment . . . low maintenance.
SAND SAMPLER
. . . for safety and ease in sand testing.
ANTI-FRICTION BEARINGS
. . . for all heavy-duty production requirements.
UNIT DRIVE
. . . integral mounting, anti-friction, helical gearing.

Here, then, is *controlled* sand mixing at its best . . . let a National Engineer show you how to cut costs and improve product quality with Simpson Mixers. Call or write for complete details.

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# BROADENING FOUNDRY HORIZONS

FOR MANY YEARS foundries have been selling a process primarily rather than a material. Most cast alloys can be worked into useable shapes by other processes. It is the economy of the casting operation which makes casting preferred even when production of a part is possible by forging, rolling, welding, machining or powder metallurgy or any combination of these.

Casting continues to be the shortest distance between raw material and finished product. But the casting industry cannot rest on its centuries-old reputation.

New developments in the foundry field are necessary for the continued advance of the industry. Commercially sponsored research and institutional research coming out of our universities and colleges, A.F.S.-sponsored research and the research of individuals with insatiable curiosity, all help promote foundry industry welfare.

One of the newest and potentially most important foundry developments concerns nodular graphite cast iron. Outgrowth of the work of Henton Morrogh and others of the British Cast Iron Research Association, who used cerium, nodular graphite cast iron was first reported publicly in this country in the April, 1948, issue of AMERICAN FOUNDRYMAN which carried his paper presented three weeks later at the 52nd Annual A.F.S. Convention. At the Convention, during the discussion of the BCIRA work, T. H. Wickenden, International Nickel Co., announced that his company had made investigations over a period of years using magnesium. These developments were subsequently made public in the February 17, 1949, issue of *Iron Age*.

The official exchange paper from the Association Technique de Fonderie de Belgique to the Association Technique de Fonderie de France by Professor Albert De Sy, University of Ghent, appeared in the January, 1949, issue of "The Foundrymen's *Own* Magazine" and in February appeared a paper by C. K. Donoho, American Cast Iron Pipe Co., Birmingham, Alabama.

These papers, and several appearing in other publications in this country and abroad, leave little doubt that the foundry industry has another process at its disposal. There is room for speculation as to whether a new material is also being produced by the methods which develop nodular graphite in iron in the as-cast condition. Also, there is much speculation on the implications of this new process for the various branches of the industry.

First examination seems to indicate that gray iron foundries will be able to produce a material similar to malleable iron without going through the annealing process and without suffering the scrap losses due to high shrinkage, contraction and breakage of hard iron. But close control of composition and the high temperature preferred are characteristic of most malleable melting units. Thus, malleable foundries seem to be in a more favorable position to make nodular graphite cast iron which is evidently closely related physically and metallurgically with the material they have been producing since the days of Seth Boyden.

Early reports on mechanical properties of nodular graphite cast iron indicate that all producers of cast metals may well be interested in the material and the process.

Best opinion to date is that nodular graphite cast iron will broaden foundry horizons and help all branches of the huge castings industry by providing a new production process and a new, albeit untried, engineering material for commerce and industry.

—*Editor.*

St. Louis

# FOUNDRY DEVELOPMENTS HIGHLIGHT 1949 A. F. S. CONVENTION PROGRAM

NEWEST FOUNDRY TECHNICAL ADVANCES in all phases of the industry will be told by America's foremost castings experts at the 53rd Annual Convention of the American Foundrymen's Society, to be held in St. Louis, May 2-5. Gray iron, malleable iron, steel, brass and bronze, aluminum and magnesium casting, patternmaking, foundry education, sand, refractories, foundry costs, plants and plant equipment, safety and hygiene, and time and motion studies will be among the major subjects discussed during four days of technical meetings.

In addition to the regular technical sessions, such annual Convention highlights as the Engineering School Graduates Luncheon, the Educational Dinner, the A.F.S. Chapter Officers and Directors' Dinner, the Canadian Dinner, the Annual Business Meeting, the Charles Edgar Hoyt Annual Lecture and the A.F.S. Alumni Dinner will be featured activities on the four-day program. Running concurrently with the Convention program will be extensive plant visitation and ladies' entertainment programs.

Entrance to Convention sessions will be by badge obtainable on registration. In accordance with a decision of the A.F.S. Board of Directors, there will be a registration fee of $5.00 for members and $7.50 for non-members, with the exceptions of the Gray Iron and Sand Shop Courses, for which no fee is required.

This year's technical Convention program will feature progress reports on A.F.S. Research Projects (see page 37); Gray Iron and Sand Shop Courses; Steel, Pattern and Malleable Round Table Luncheons; and for the first time, a Gray Iron Round Table Luncheon; and joint Gray Iron-Malleable Division and Gray Iron-Steel Division technical meetings, in addition to the regular technical meetings. The technical program will take place mornings, afternoons and evenings.

*Illuminated fountain in St. Louis' Forest Park.*

Technical sessions planned for the 53rd Convention include seven on gray iron, four on aluminum and magnesium, four each for brass and bronze, malleable and steel, two for education and two for pattern.

The program of the Gray Iron Division will begin at 8:00 p.m. Monday night, May 2, with the first of three Gray Iron Shop Courses, at which W. W. Levi, Lynchburg Foundry Co., Lynchburg, Va., will speak on *"Carbon Trends in Gray Iron."*

### Hold Joint Symposium on Nodular Graphite

The following afternoon, May 3, at 4:00 p.m. the Gray Iron and Malleable Divisions will hold a joint symposium on *"Production of Nodular Graphite Gray Iron."* At the Tuesday evening Gray Iron Shop Course, a discussion on *"Inexpensive Tests for Small Gray Iron Foundries"* will be led by W. Bohn, Buick Motor Division, General Motors Corp., Flint, Mich.

Wednesday's Gray Iron Division program will begin with a technical session at 10:00 a.m. followed by another meeting at 4:00 in the afternoon. At 8 p.m. there is joint session of the Gray Iron and Steel Divisions, at which two motion pictures, *"Finger Gating"* and *"Step Gating"* will be shown by W. H. Johnson and W. O. Baker, Naval Research Laboratory, Washington, D. C. Held simultaneously, at 8:00 p.m., May 4, the third and last Gray Iron Shop Course will feature a panel on *"Sources of Metal Losses in the Foundry."*

The Thursday, May 5, gray iron program will begin with a technical session at 10:00 a.m., followed by the Gray Iron Round Table Luncheon, held for the first time, at which H. F. Taylor, Massachusetts Institute of Technology, and N. A. Birch, American Brake Shoe Co., Mahwah, N. J., will lead a discussion on *"Gating and Risering."* The final meeting sponsored by the Gray Iron Division will be a technical session held at 4:00 p.m., Thursday.

Beginning at 10:00 a.m., Wednesday, the program of the Steel Division will open with a technical session featuring three addresses: *"A New Method for Determining Austenitic Grain Size of Cast Steel,"* by E. J. Eckel, University of Illinois, and S. J. Paprocki, Battelle Memorial Institute, Columbus; *"Note on As-Cast Structure and Grain Size in Cast Alloy Steels,"* by E. A. Loria, Mellon Institute of Industrial Research, Pitts-

burgh; and *"Prevention of Hot Tears in Thick-Walled Centrifugally Cast Steel Tubes,"* by J. F. Wallace and J. L. Martin, Watertown Arsenal, Watertown, Mass.

At 8:00 p.m., Wednesday, May 4, the Steel Division and Gray Iron Division will hold a joint session at which W. H. Johnson and W. O. Baker of the Naval Research Laboratory, Washington, D. C., will present films on *"Finger Gating"* and *"Step Gating."*

The Thursday morning, May 5, steel technical session at 10:00 a.m. will feature two addresses: *"Rapid Analysis of Acid Slags,"* by E. C. Zuppann, Wilson Foundry & Machine Co., Pontiac, Mich., and A. E. Martin, University of Minnesota, and *"A Study of Insulating and Mildly Exothermic Antipiping Compounds Used for Steel Castings,"* by S. L. Gertsman, Canadian Bureau of Mines, Ottawa, Ont.

### Steel Round Table Luncheon

The Steel Round Table Luncheon, to be held at 12:00 noon, will have as its subject *"Sand Testing and Its Relation to Casting Defects."* At 4:00 p.m. C. E. Sims, H. A. Saller and F. W. Boulger, all of Battelle Memorial Institute, will present *"Effect of Various Deoxidizers on the Structure of Sulphide Inclusions,"* with J. F. Wallace, Watertown Arsenal, speaking on *"Effect of Aluminum and Vanadium on the Toughness of High-Hardenability Cast Steel."*

One of the opening technical sessions of the Convention, at 10:00 a.m., Monday, May 2, will begin the Malleable Division program, with J. E. Rehder, Canadian Bureau of Mines, speaking on *"Effects of Temperature and Silicon Content on First Stage Annealing of Blackheart Malleable Iron,"* and a progress report on the Malleable Iron Research Project being carried on at the University of Michigan.

### Stress Malleable Annealing Practice

At 2:00 p.m., May 2, the malleable session will have addresses on *"Influence of Type of Slag on Heat Treatment Susceptibility of Malleable Iron,"* by G. Vennerholm and H. N. Bogart, Ford Motor Co., Dearborn, Mich., and *"Influence of Heating Rate on First Stage Graphitization of White Cast Iron,"* by R. Schneidewind, University of Michigan, and D. J. Reese, International Nickel Co., New York.

The 4:00 p.m. Monday malleable technical session will feature papers by R. W. Heine, University of Wisconsin, on *"Some Effects of Deoxidation Treatments on Graphitization of White Cast Iron,"* and J. E. Rehder, Canadian Bureau of Mines, on *"Influence of Silicon Content on Critical Temperature Range During Slow Cooling of Blackheart Malleable Iron."*

Tuesday morning, May 3, will open with a 10:00 a.m. technical session on *"Controlled Atmosphere Annealing of Malleable Iron,"* by R. P. Schauss, Illinois Clay Products Co., Chicago, and *"Maintenance in a Mechanized Foundry,"* by C. T. Luther, Central Foundry Division, General Motors Corp. (see page 61).

The Malleable Round Table Luncheon, to be held at 12:00 noon, May 3, will feature two discussions: *"Reduction of Losses Due to Cracks or Tears,"* led by R. J. Anderson, Belle City Malleable Iron Co., Racine, Wis., and K. H. Hamblin, The Grinnell Co., Providence, R. I., and *"Improved Malleable Melting Refractories,"* led by M. J. Henley, Texas Foundries, Inc., Lufkin, Texas, and F. Czapski, Chicago Malleable Castings Co., Chicago.

*One of the picturesque beauty spots in Forest Park.*

The final Malleable Division technical session will be held jointly with the Gray Iron Division at 4:00 p.m. May 3, and will be a symposium on *"Production of Nodular Graphite Gray Iron."*

### Three Papers Open Brass & Bronze Program

Beginning on Monday morning, the Brass and Bronze Division will open its program with a technical session at 10:00 a.m., featuring three addresses: *"Casting Finish,"* H. H. Fairfield and J. MacConachie, Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.; *"Effects of Melting Atmosphere, Time at Temperature and Degasification on Properties of Valve Bronze,"* W. H. Baer and B. M. Loring, Naval Research Laboratory, Washington, D. C.; and *"Practical Melting and Its Relation to Gases in Metal,"* O. E. Decker, Acheson Manufacturing Co., Pittsburgh. A second technical session will take place at 4:00 p.m., Monday.

Tuesday's 10:00 a.m. Brass and Bronze technical session will be on the *"Effect of Composition on Properties and Structure of Cast Monel,"* by J. T. Eash, International Nickel Co., Bayonne, N. J.

Immediately following, the Brass and Bronze Round Table Luncheon at 12:00 noon Tuesday, will be devoted to a discussion on *"Some Practical Applications of the Fundamental Principles of Melting, Pouring and Casting of Tin Bronzes,"* with the following discussion leaders: *Melting*, H. M. St. John, Crane Co., Chicago; *Pouring*, L. W. Eastwood, Battelle Memorial Institute;

*Huge crowds view operettas on summer nights in St. Louis' world-famed outdoor Municipal Opera Theater.*

*Sand,* C. A. Robeck, Gibson & Kirk Co., Baltimore; and *Gates and Risers,* G. Bradshaw, Philadelphia Naval Shipyard, Philadelphia.

The Aluminum and Magnesium Division's program will open with a technical session at 10:00 a.m., Monday, May 2, with papers by A. M. Montgomery, Aluminum Company of America, Cleveland, *"Metallography of Aluminum Casting Alloys,"* and P. F. George, Dow Chemical Co., Midland, Mich., on *"Metallography of Cast Magnesium Alloys."*

### Aluminum & Magnesium Round Table

Following this, at 12:00 noon, Monday, the Aluminum and Magnesium Round Table Luncheon, will feature a progress report and motion picture, *"Hydraulics of Flow in a Mold,"* on the Aluminum and Magnesium Research Project at Battelle Memorial Institute.

The 10:00 a.m., Tuesday, light metals technical session will feature two papers: *"Designing Magnesium Castings for Aircraft Engines,"* by M. H. Young and A. G. Slachta (appearing on pages 41-45 of this issue); and *"Design of Light Metal Castings,"* by G. H. Found, Dow Chemical Co., Midland, Mich.

The final session, at 2:00 p.m. Tuesday, May 3, will have three papers: *"Correlation of Cooling Curve Data With Casting Characteristics of Aluminum Alloys,"* by E. E. Stonebrook and W. E. Sicha, Aluminum Company of America, Cleveland; *"Fluxing of Aluminum Alloys,"* a committee report to be presented by H. Brown, Solar Aircraft Co., Des Moines, Ia.; and *"Grain Refining of Aluminum Alloys and Its Effect on Physical Properties,"* by W. Bonsack and O. Tichy, Apex Smelting Co.

### Hold Sand Shop Course Sessions

Three Sand Shop Course sessions, to be held the evenings of May 2, 3, 4 and two sand technical sessions, set for the afternoon of May 3, make up the Sand Division's program. The first Sand Shop Course meeting will be held Monday at 8:00 p.m. on *"Causes of Penetration in Steel Castings,"* with E. E. Woodliff, Foundry Sand Service Engineering Co., Detroit, leading the discussion. The sand technical sessions will take place at 2:00 and 4:00 p.m. on Tuesday.

Second Sand Shop Course session, to be held at 8:00 p.m., May 3, will have as its subject *"Resin Sand Cores vs. Oil Sand Cores,"* with T. W. Curry, Lynchburg Foundry Co., Lynchburg, Va., leading the discussion.

The third and final Sand Shop Course meeting will be held at 8:00 p.m., Wednesday, May 4, and will deal with *"Core Sand Blowing Practice."* H. Schutzenhoffer, The Key Co., East St. Louis, Ill., will lead discussion.

The Pattern Division's program will consist of one technical session the afternoon of May 3 and the Pattern Round Table Luncheon, May 4.

The activities of the Educational Division will include the annual Educational Dinner at 6:30 p.m., Monday, May 2, and the Engineering School Graduates' Luncheon at noon of the same day.

The Heat Transfer Committee's technical session will be held at 10:00 a.m., Tuesday, May 3, and will consist of a progress report on Heat Transfer Research on *"Comparative Solidification Studies"* at Columbia University given by V. Paschkis of Columbia University. Dr. Paschkis will also present a paper on *"The Foundryman and Heat Transfer"* at the same session.

The Time Study and Methods technical session will take place at 2:00 p.m., Tuesday, May 3, and will be on *"Developing Standard Data Tables for a Four-Man Molding Unit,"* by M. T. Sell, Sterling Foundry Co., Wellington, Ohio.

The Foundry Cost Session at 4:00 p.m., May 3, will feature *"Approach to Standard Costs in the Foundry,"* by F. Ruffalo, Westover Engineers, Milwaukee; and a question and answer period on cost problems of general interest, methods of cost accounting, distribution of costs, etc.

The Refractories Committee's technical session is scheduled for 4:00 p.m., Tuesday, May 3.

The Plant and Plant Equipment technical session will be held at 8:00 p.m., Tuesday evening, May 3, and will be on *"Modern Foundry Core and Mold Ovens,"* by C. A. Barnett, Foundry Equipment Co., Cleveland.

A feature of earlier A.F.S. Conventions revived this year, will be a Safety & Hygiene technical session, at which Dr. Lloyd E. Hamlin, medical director, American Brake Shoe Co., and George Tubich of the Michigan Department of Health, will speak.

## Apprentice Contest Entries Must Be Shipped To Meet March 26 Deadline

1949 A.F.S. APPRENTICE CONTEST ENTRIES must arrive for judging not later than March 26, according to the A.F.S. Apprentice Contest Committee. Information has been sent all entering organizations, directing them where to ship their respective entries. Castings entries are to be shipped either to the Scullin Steel Co., 6700 Manchester Ave., St. Louis 10, or American Steel Foundries, Inc., 1700 Walnut St., Granite City, Ill., as previously directed by the Committee, for X-raying for internal soundness. Patterns are to be shipped to the David Rankin, Jr., Trade School, 4431 Finney Ave., St. Louis, 13.

Late contestants are requested to ship their castings entries directly to the Scullin Steel Co., where the judging will take place, to avoid delays in meeting the March 26 deadline. The Contest closed March 15.

Contest entries will be exhibited at the 1949 A.F.S. Convention in St. Louis, May 2-5 and winners announced. The first place winners in each of the Contest divisions will be awarded cash prizes and certificates at the Convention's Annual Business Meeting by A.F.S. National President W. B. Wallis. Following the Convention, winning entries will be displayed at Chicago's Museum of Science and Industry for one year.

## SORRY, WRONG CURTAIN

In the article *"Eighteen Days Behind the 'Iron Curtain,'"* AMERICAN FOUNDRYMAN, January, 1949, the term "Soviet 'Iron Curtain'" was used. The word "Soviet" was inadvertently inserted by the editor and was not in the original manuscript of Lester B. Knight, Lester B. Knight & Associates, Inc., Chicago, who spent 18 days visiting foundries and industrial plants as official A.F.S. delegate to the First Postwar International Foundry Congress in Prague during September.

*Prominent Michigan industrialists and educators who make up the Donors' Committee for the Hackley Trade School Foundry Program are, left to right: Lyman Thunfors, Paul M. Wiener Foundry Co.; James Seyferth, West Michigan Steel Foundry Co.; Erwin Jones, Lakey Foundry & Machine Co.; R. J. Mason, Muskegon Manufacturers' Association; Chairman George W. Cannon (standing), Campbell, Wyant & Cannon Foundry Co.; Adam Pyle, Jr., Pyle Pattern & Mfg. Co.; E. W. Beach, Campbell Wyant & Cannon Foundry Co.; C. W. Bemer and Richard B. Warren of the Muskegon Public School System.*

# MICHIGAN FOUNDRYMEN RESTORE TRADE SCHOOL FOUNDRY PROGRAM

REBIRTH OF FOUNDRY PRE-EMPLOYMENT COURSES after almost two decades of inactivity at Muskegon's Hackley Manual Training High School on February 15 marked the fruition of more than two years' effort by Michigan founders, educators and industrialists, working in collaboration with the Western Michigan Chapter of A.F.S., to provide the finest of high-school level foundry training facilities for Muskegon youth.

Scores of Midwestern foundry notables attended dedicatory ceremonies at the school on February 15 and watched the first Hackley foundry class in 18 years being put through its paces in all phases of the foundry art. Prominent Michigan public officials, headed by Mayor Henry J. DeVette of Muskegon, and Dr. Ralph Wenrich, head of the State Board for Control of Vocational Education, watched George W. Cannon, chairman of the board of Campbell, Wyant & Cannon Foundry Co., Muskegon, and chairman of the project's Donors' Committee, pour the first mold, and A.F.S. Past National President Fred J. Walls, International Nickel Co., Detroit, shake out the first casting during opening day ceremonies.

More than 50 prominent founders and educators attended a formal dinner at the Occidental Hotel, Muskegon, following the ceremonies and witnessed the transfer of foundry facilities from the Donors' Committee to the Muskegon Board of Education. Speakers at the dinner were Donors' Committee Chairman George W. Cannon; Dr. W. B. Steele, president of the Muskegon Board of Education, who accepted the donation on behalf of the City; Muskegon Superintendent of Schools C. W. Bemer; Dr. Ralph Wenrich; Mayor H. J. DeVette; A.F.S. National Secretary-Treasurer Wm. W. Maloney, Chicago; W. A. Hallberg, Lakey Foundry & Machine Co., Inc., chairman of the Western Michigan Chapter of A.F.S.; L. E. Roark, executive vice-president of the National Foundry Association, Chicago; I. Richard Wagner, Electric Steel Castings Co., Indianapolis; Harry E. Ladwig, Allis-Chalmers Mfg. Co., Milwaukee; and Robert J. Mason, Muskegon Manufacturers' Association. Others at the speakers' table were G. W. Manning, principal, Muskegon Senior High School; R. B. Warren, assistant

*George W. Cannon of Campbell, Wyant & Cannon Foundry Co., pours the first mold during opening day ceremonies at the Hackley School, February 15.*

*Left: Pouring molds prepared by the class. Center: Learning use of sand testing instruments. Right: All students learn to charge and operate electric furnace and to handle ladles and pour molds properly.*

superintendent of schools, Muskegon; and E. Huttenga, director of Vocational Training, Muskegon.

The formal dinner culminated more than two years of intensive planning and work on the part of industrialists and educators of the Muskegon area, cooperating with the Western Michigan Chapter of the American Foundrymen's Society, the Muskegon Manufacturers' Association and State and City groups.

Begun in 1946 as the result of a survey which showed that 22 per cent of the employed persons in the Muskegon area were on the payrolls of foundries or allied enterprises, the movement to revive foundry courses at the Hackley School after 18 years of dormancy was started cooperatively between the Muskegon Board of Education and the foundry group of the Muskegon Manufacturers' Association.

At that time, the Hackley Manual Training High School's foundry equipment consisted of a small cupola, two molding benches, a small tumbling barrel and a grinder.

The foundry group appointed an engineering subcommittee to prepare plans for a completely modern foundry layout, and to estimate the cost of equipping such a project. Foundries throughout the Muskegon area offered the services of their skilled engineering personnel for this purpose and plans were submitted within a few months for a model foundry, complete with the most modern foundry and safety equipment. As an example of the thoroughness of the remodeling, when the plans were ultimately carried out, a brick surface was laid over the old concrete floor, a modern washroom with showers and lockers was added, and every possible device for the safety of the students was installed. The subcommittee was headed by E. W. Beach of Campbell, Wyant & Cannon.

The mechanical equipment includes an electric furnace, to enable daily casting demonstrations to be held; hand and pneumatically-operated molding machines; a shot-blast cleaner; modern molding benches with complete equipment for each student; and a mechanical sand mixer. A complete laboratory for sand and core testing was also installed. The cost of renovating Hackley's dormant foundry department was estimated at $20,000.

### Organize Donors' Committee

Following acceptance of the subcommittee's plan and cost estimate, a separate Donors' Group was organized, independent of the Muskegon Manufacturers' Association, consisting of executives of local foundries, foundry equipment manufacturers, building and steel fabricating organizations and trucking firms, all of whom contributed. School executives were appointed to the Committee to speed up exchange of information between school and industry.

Headed by George W. Cannon, its members, representing over 50 contributors, are as follows:

R. J. Mason, secretary-treasurer, Muskegon Manufacturers' Association; J. O. Ostergren, president, Lakey Foundry & Machine Co.; Adam Pyle, Jr., secretary-treasurer, Pyle Pattern & Mfg. Co.; Otto Seyferth, president, West Michigan Steel Foundry Co., later represented by James R. Seyferth; Paul M. Wiener,

*Notables present at the Hackley School's foundry opening day ceremonies were, left to right, A.F.S. National Director Frank C. Riecks, Ford Motor Co.; L. E. Roark, National Foundry Association; A.F.S. National Secretary-Treasurer Wm. W. Maloney; I. R. Wagner, Electric Steel Castings Co., Indianapolis; H. E. Ladwig, Allis-Chalmers Mfg. Co., Milwaukee; and G. W. Cannon, Campbell, Wyant & Cannon Fdy. Co.*

president, Paul M. Wiener Foundry Co.: Richard B. Warren, assistant superintendent of schools, Muskegon; and Edward Huttenga, director of vocational training, Muskegon. The Western Michigan Chapter contributed the proceeds of its annual outing last summer.

With the necessary funds pledged and plans approved the Muskegon Board of Education took over the task of preparing the building and installing the equipment approved by the Donor's Committee. Next in importance was the engaging of an instructor for the course. Adrian J. Archambault, a qualified journeyman foundryman, who had spent the last seven years as a circuit foundry instructor for Wisconsin's State Board of Vocational and Adult Education, was selected for the position.

### A.F.S. Chapter Acts As Advisor

In order to continue the cooperative supervision of the school by experienced foundry personnel, the Western Michigan Chapter of the American Foundrymen's Society was asked to provide special advisory subcommittees, consisting of two or three members each, whose duties are to assist the foundry school manager-instructor at his request from time to time. These subcommittees cover such classifications as: general foundry work, sand and sand mixing, sand laboratory work, core making, molding, patterns, melting and pouring, cleaning, grinding and shot blasting, inspection, electrical equipment, mechanical equipment, purchasing, chemical laboratory and time standards.

Curricula of the Hackley Manual Training High School are briefly as follows:

In seventh, eighth and ninth grades, eight units of exploratory work in various shop practices, including those of the foundry are offered. These units vary in length with the subject being covered; foundry training is elementary and devoted to basic principles.

In the tenth grade the student prepares himself for the trade of his choice, based on his experiences at the junior high level. He then takes two semesters of related courses, called the "industrial cycle", which includes training in mechanical drawing, patternmaking, foundry, machining and finishing.

At the eleventh grade level, the student enters the foundry practice class, taking a half hour's instruction each day in all foundry operations, from sand preparation through pouring molds, and is thoroughly grounded in laboratory technique.

*Members of Western Michigan Chapter's Advisory-Contact Committee to the Hackley Manual Training High School are, left to right: G. W. Myers, West Michigan Steel Foundry Co.; Chapter Director E. G. Grant, Paul Weiner Foundry Co.; Chapter Chairman W. A. Hallberg, Lakey Foundry & Machine Co.; and Director H. C. BeMent, Campbell, Wyant & Cannon.*

When the student reaches the twelfth grade he is permitted to take an advanced course consisting of three hours of foundry practice each day, and thus upon graduation from the school is equipped to become a skilled workman in whichever field of foundry operation he is best fitted for by aptitude.

In addition to formal class training, it is also planned to present foundry films and to conduct local plant visitations. The Committee further hopes to arrange a schedule of prominent speakers to address classes on various fields of foundry practice in more detail than is covered in the regular classroom lectures.

From this comprehensive program it can readily be seen that the farsighted efforts of the Michigan founders, educators and industrialists who have contributed to the rehabilitation of the Hackley School Pre-Employment Foundry Course will pay thousand-fold dividends in attracting "new blood" to the foundries of the Muskegon area—alert, highly trained young men equipped to do an intelligent job in "Making the Foundry a *Good* Place to Work."

*(Continued on Page 92)*

*Left to right: (1) Removing pattern from drag section of mold, (2) Riddling sand over drag pattern, (3) Instructor explains some fine points of making a core to a student, (4) Blast cleaning castings.*

# WISCONSIN REGIONAL CONFERENCE

MIDWEST FOUNDRYMEN attending the 12th Annual Wisconsin Regional Foundry Conference in Milwaukee, February 10 and 11, heard speakers at 23 sessions discuss foundry, pattern shop and laboratory techniques current in the castings industry. With over 500 registered, the sessions were well attended.

Traditional opening by a staff member of the University of Wisconsin, co-sponsor of the Conference with the Wisconsin Chapter, was delayed when a minor bus accident held up the arrival of Dean M. O. Withey and Professors G. J. Barker and E. R. Shorey. Second speaker on the program A.F.S. President W. B. Wallis, filled the gap at the request of Wisconsin Chapter President R. C. Woodward, Bucyrus-Erie Co.

Mr. Wallis outlined the purpose and scope of the American Foundrymen's Society, citing its services to the castings industry and its growth in 53 years from a few hundred to over 10,000 foundrymen. Tracing the growth of the Regional Conference movement—ten are scheduled for 1949—he pointed to the gatherings as a means for spreading information first hand to men unable to attend A.F.S. Annual Conventions.

On Dean Withey's arrival the Conference was officially declared open and the Dean discussed the growth of the University of Wisconsin.

Sessions the first day included two sets of simultaneous meetings on steel, gray iron, malleable iron, non-ferrous, pattern and technical subjects. Querying *"What Do We Know About Sand?"* J. B. Caine, Sawbrook Steel Castings Co., Lockland, Ohio, started the steel series by reviewing current knowledge of sand.

*Tablemates during one of the luncheon sessions were, left to right, Walter Gerlinger, Walter Gerlinger, Inc.; Harry Ladwig, Allis-Chalmers Mfg. Co.; and B. D. Claffey, Acme Aluminum Alloys, Inc., Dayton, Ohio; all Past Presidents of the Wisconsin Chapter. (Photographs by W. V. Napp, Badger Firebrick Co.)*

Chairman and co-chairman at the meeting were Eugene Schneider, Grede Foundries, Inc., and V. E. Ziemer, Maynard Electric Steel Casting Co.

First gray-iron speaker was W. Harvey Payne, Foundry Equipment Co., Chicago, who discussed core baking problems, fundamentals and variables. H. K. Sohner, International Harvester Co., and A. James, Jr., Standard Foundry Co., were co-chairmen.

Major core room problem is to incorporate principal requirements in malleable cores at a reasonable cost according to Eric Welander, Union Malleable Iron Works, East Moline, Ill. Speaking at the first malleable session, he emphasized the importance of core sand selection. In discussing core blowing he described experiments which showed that very little segregation takes place, contradicting the common belief that the smaller grains go to the outside of the core and form a smoother surface.

Presiding at this malleable session were Martin Harder, Lakeside Malleable Castings Co., and H. C. Stone, Belle City Malleable Castings Co., Racine, Wis.

Carl Van Buren, Allis-Chalmers Mfg. Co., and John Kammermeyer, American Smelting & Refining Co., were co-chairmen at the first non-ferrous session. Speaker was Charles E. Schley, Philadelphia Bronze & Brass Corp., Philadelphia. Speaking on *"Cement Molding in the Non-Ferrous Foundry,"* he said this practice nearly eliminates scabs, gives castings true to pattern and eliminates core shifts if the core fits the print. Other advantages cited are lower machining cost because less finishing allowance is required and elimination of special flask equipment because the mold is rigid when set.

### Stresses Planning of Patterns

*"What a Foundryman Expects of Pattern Equipment"* was explained by Walter Baltan, Link Belt Co., at the early afternoon pattern session.* Albert Huebner, Allis-Chalmers Mfg. Co., and Leonard Gratz, G. and O. Pattern Works, presided. The speaker stressed the importance of planning patterns from the blueprint stage and urged conferences with foundry personnel on molding methods, gating and risering, selection of flask size, coring and avoidance of high cleaning cost. Patterns must be accurate, durable, and loose pieces should be plainly marked, he said.

Speaker at the first technical session was Prof. P. C. Rosenthal, University of Wisconsin, who discussed *"Basic Principles Common to Foundry Melting Practice."* Meeting chairmen were David Fahlberg, Grede Foundries, Inc., and Dr. Harold Haase of Marquette University, Milwaukee. Prof. Rosenthal explained melting in the foundry does not involve refining except in the case of steel and white iron. He pointed out that melting generally oxidizes the melt and that deoxidation frequently is required.

Grain size control methods are not well developed, the speaker said, in citing steel, magnesium alloys and gray iron as metals that have been treated for grain refinement. In gray iron foundrymen strive primarily for control of graphite flake size and distribution.

Charles Locke, Armour Research Foundation, Chi-

* Patternmaking sessions are reported by Jacob R. VanKooy, patternmaking instructor, Milwaukee Vocational School.

cago, spoke on *"Some Modern Concepts of the Theory of Risering"* at the second steel meeting. Presiding were A. M. Herrmann, Racine Steel Castings Co., Racine, Wis., and Louis Shaw, Pelton Steel Castings Co.

Two basic methods have been used to determine the effect of molding materials on castings solidification, Mr. Locke explained in pointing out that understanding of thermal characteristics of a mold are fundamental to solidification and risering. He cited the well-known work of C. W. Briggs and R. A. Gezelius who used an empirical approach in experiments at the Naval Research Laboratory. A second approach, based on the physics of heat transfer, is used in the A.F.S.-sponsored research project carried on at Columbia University, New York, under Society auspices since 1944.

Using his audience to develop his topic, Harry E. Gravlin, Ford Motor Co., Dearborn, Mich., led a discussion on *"Sand, Metal or Men."* Chairmen at this second gray iron session were George Antonic, Walter Gerlinger, Inc., and Lester Woehlke, Grede Foundries, Inc. The speaker displayed defective castings and got his audience to agree on identity of defects and to explain their causes. Questioning the foundrymen, who thought they were there merely to listen, Mr. Gravlin brought out the experiences of many of the group.

### Discusses Malleable Sand Control

*"Things to Consider in Malleable Sand Control"* were brought out at the late afternoon malleable meeting. Earl E. Woodliff, Foundry Sand Service Engineering Co., Detroit, was the speaker, with E. B. Hansen, Wisconsin Appleton Co. and C. M. Lewis, Badger Malleable & Mfg. Co., presiding.

Development of high quality aluminum alloy castings on a mass production basis was traced in his talk, *"Producing Specification Aluminum Castings,"* by B. D. Claffey, Acme Aluminum Alloys Co., Dayton, Ohio, at the second non-ferrous meeting. Chairman and co-chairman were speaker B. D. Claffey's son, James Claffey, General Malleable Corp., Waukesha, Wis., and Carl Van Buren.

Mr. Claffey described sand cast and permanent mold castings and pointed to the advances in design and non-destructive inspection which have resulted from foundry engineering and research.

Frank M. Kulka, Motor Castings Co., spoke and A. M. Fischer, Charles Jurack Co., and W. Kollmorgen, Kollmorgen Pattern Works, presided at the late afternoon pattern session. The speaker discussed gating, risering, core blowing and sand problems related to production of cast motor parts and similar castings.

*Harry E. Gravlin, Ford Motor Co., Dearborn, Mich., leading a spirited session on "Sand, Metals or Men."*

*Seated at the speakers' table at the banquet were, left to right, A.F.S. National President W. B. Wallis; Dr. J. M. Klotsche, president, Wisconsin State Teachers' College, speaker; and Wisconsin Chapter President R. C. Woodward of the Bucyrus-Erie Co.*

Second technical session attendants heard J. B. Caine discuss *"What is Strength?"* Chairman was Dr. Harold Haase with Norman Koch, Grede Foundries, Inc., as co-chairman.

No single test determines the quality or usefulness of a casting, according to Mr. Caine. Serviceability can only be determined in actual service, the best alternative being a simulated service test. Yield strength is the most important single property from a service standpoint, he said.

*"Reproducibility of Mechanical Tests,"* was discussed at the Friday morning steel meeting by Dr. W. K. Bock, National Malleable & Steel Castings Co., Cleveland. E. G. Tetzlaff, Pelton Steel Castings Co., and G. V. Jedinak, Sivyer Steel Castings Co., presided.

How to answer questions arising from problems in reproducing mechanical properties was explained by Dr. Bock in delivering his paper which will appear in AMERICAN FOUNDRYMAN.

### Outlines Buyers' Casting Requirements

Agreement on responsibility for defective castings was discussed at the second day's morning gray iron session by Ben G. Thiel, Waukesha Motors Co., Waukesha, Wis., speaking on *"What the Purchaser Expects from the Foundry."* Leslie Woehlke and H. K. Sohner were chairman and co-chairman.

Grinding problems were outlined at the third Conference malleable session by A. S. Rakestraw, Norton Co. C. M. Lewis and E. B. Hansen presided.

Non-ferrous foundry men and patternmakers held a joint session the morning of the second day to hear S. Sandelin, Central Pattern Works, and Timothy Cox, Speed Meal Corp., explain *"Factors to be Considered when Making Permanent Molds."* Presiding were M. Frankard, Delta Mfg. Co., and A. R. Tooman.

Recommending that non-ferrous sand casting foundries make wider use of permanent molds, the speakers pointed out that heat and spraying of the molds are the biggest problems.

Color photography and polarized light are valuable metallographic tools according to Charles S. Foster, Eastman Kodak Co., Rochester, N. Y., who spoke at the Friday morning technical session. He explained and illustrated identification of microconstituents

*Charles Schley (left), Philadelphia Brass & Bronze Corp., a technical speaker at the Conference, poses with R. M. Jacobs, Standard Brass Works, Milwaukee.*

which appear the same under ordinary illumination but different by polarized light.

Roy McIntosh, Belle City Malleable Iron Co., Racine, Wis., and Adolph Popovich, Allis-Chalmers Mfg. Co., were chairman and vice-chairman of the meeting.

The Conference concluded with six simultaneous sessions Friday afternoon. At the steel meeting, William J. Phillips, Steel Founders' Society of America, Cleveland, spoke on *"Improving the Quality of Steel Castings to Offset Substitute Materials."* Presiding were O. H. Kraft, Bucyrus-Erie Co., and Charles Fuerst, Falk Corp.

Current difficulties with coke, scrap and pig were covered by H. Kenneth Briggs, Miller and Co., Chicago, in his talk, *"Observations on Cupola and Related Problems in the Foundry."* J. V. Olle, Motor Castings Co., and H. K. Sohner were chairman and co-chairman of this final gray iron session.

### Explains Effects of Dissolved Gases

Effects of dissolved gases are little understood according to Prof. Richard W. Heine, University of Wisconsin. He spoke on deoxidation of white cast iron and its application to malleable iron at the concluding malleable session. H. C. Stone was co-chairman with Paul J. Anderson, International Harvester Co.

Pointing to evidence that shows white iron is relatively poorly deoxidized in spite of a silicon content higher than steel, Prof. Heine described his recent experiments in adding aluminum, ferro-titanium, a zirconium alloy and hydrogen to induction melted white iron. These will be reported in detail at the 53rd Annual A.F.S. Convention St. Louis, May 2-5.

Final non-ferrous meeting was an information forum with M. E. Nevins, Wisconsin Centrifugal Foundry, Inc., as moderator and as panel members A. K. Higgins, Allis-Chalmers Mfg. Co., William M. Ball, Jr., R. Lavin & Sons, Chicago, E. P. Mooney, American Smelting & Refining Co., and George W. Anselman, Woodruff & Edwards Co., Elgin, Ill. Presiding were C. P. Kotowicz, Ampco Metal, Inc., and A. R. Tooman.

Pattern makers ended the Conference with a symposium on plastic patterns. Speakers were A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Martin Rintz, Continental Foundry & Machine Co., East Chicago, Ind., and Steve Denkinger, Jr., Atlas Plastic & Aluminum Pressure Plate Co. Albert Huebner was chairman with Leonard Gratz as co-chairman.

The technical group closed its Conference sessions with a paper on *"New Tests for Molding Sands"* by Prof. C. C. Sigerfoos, Michigan State College. Presiding were Bradley H. Booth, Carpenter Bros., and Kenneth Geist, Allis-Chalmers.

Prof. Sigerfoos described a simple inexpensive apparatus for determining the tendency of sand mixtures to scab or buckle. Simulating actual foundry conditions, the test involves exposure of a 6 in. circular cope of a test mold to radiant heat from molten metal at casting temperatures.

Special Conference functions included a banquet, the evening of February 10, with Dr. J. M. Klotsche, president of Wisconsin State Teachers College, speaking on *"The Destiny that is Ours."* R. C. Woodward, Chapter President, presided. Dr. Klotsche said that the United States is the only nation with both the moral sense and the productive capacity to enable it to assume world leadership.

### Tells of European Trip

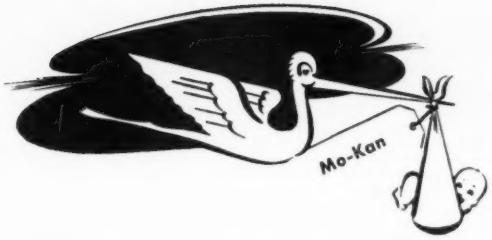
The international theme was continued at luncheon the second day of the Conference when Arthur L. Grede, Grede Foundries, Inc., gave his impressions of Europe based on a trip to Northern European countries last summer with a delegation of Milwaukee business and industrial leaders. Presiding at the luncheon was Conference Co-Chairman W. W. Edens, Badger Brass & Aluminum Foundry Co.

Basing his predictions of things to come in the foundry industry on past developments, Frank G. Steinebach, Penton Publishing Co., Cleveland, foresaw continued mechanization and a drop in annual castings production of about a million tons. He spoke at the first day's luncheon meeting.

Members of the Wisconsin Chapter of A.F.S. who managed the Chapter's 12th Annual Regional Foundry Conference are A. C. Haack, Conference Chairman and Chapter Vice-President: W. W. Edens, Badger Brass & Aluminum Foundry Co., Conference Co-chairman and Chapter Secretary, and Professors E. R. Shorey and G. J. Barker of the University of Wisconsin.

Special Conference assignments were held by Leon H. Decker, Allis-Chalmers Mfg. Co., treasurer; E. C. Meagher, Chicago Retort & Firebrick Co., ticket chairman, and George E. Tisdale, Zenith Foundry Co., general program chairman.

Responsible for planning the various sessions of the Conference were Albert Huebner, Allis-Chalmers Mfg. Co. and Leonard Gratz, G. & O. Pattern Works, pattern; Charles Fuerst, Falk Corp., and O. H. Kraft, Bucyrus-Erie Co., steel; Harold K. Sohner, International Harvester Co., and George Antonic, Walter Gerlinger Inc., gray iron; Paul J. Anderson, International Harvester Co., and E. B. Hansen, Wisconsin Appleton Co., malleable iron; C. Kotowicz, Ampco Metal, Inc., and A. R. Tooman, Racine Aluminum & Brass Foundry Co., non-ferrous; Bradley H. Booth, Carpenter Bros., and Roy McIntosh, Belle City Malleable Iron Co., technical.




## Kansas, Missouri Founders Petition A.F.S. for Mo-Kan Chapter Charter

A.F.S.' 40TH CHAPTER, the Mo-Kan, was born February 16 at Rockhurst College, Kansas City, Mo., when 55 foundrymen from Kansas and Missouri met to petition for approval as a chapter.

The February 16, meeting, fourth in a series of technical meetings held by the Mo-Kan Chapter since last summer, was held at Conway Hall on the Rockhurst College campus.

Temporary Chairman Clarence Culbertson, Warren Coke Co., Kansas City, Mo., introduced the speaker of the evening, Clyde A. Sanders, American Colloid Co., Chicago, whose topic was *"Casting Defects and Sand Practice."*

Mr. Sanders outlined practical methods of determining causes of defects in castings and offered means of removing the causes of the various defects through sand control. He explained the importance of wide grain distribution to sand properties and casting finish and discussed influence of mold density.

Following Mr. Sanders' address, a nominating committee was chosen to select chapter officers, who will be voted upon by letter ballot. The results of the ballot will be announced at the next meeting of the chapter, March 21.

Serving temporarily as officers and directors of the Mo-Kan Chapter are:

*Chairman:* C. W. Culbertson, M. W. Warren Coke Co., *vice-chairman*, J. T. Westwood, Blue Valley Foundry; *secretary-treasurer*, C. W. Myers, Jr., Morton-Myers Co.; all of Kansas City, Mo.

*Directors:* Milton B. Gold, Gold Foundry & Machine Works, Independence, Mo.; E. C. Austin, Jr., National Brass & Aluminum Foundry, Inc., Independence, Mo.; E. C. Sooy, Kansas City Hay Press Co., Kansas City, Mo.; and Alan G. Lindley, Automotive Finished Materials Co., Atchison, Kan.

Messrs. Culbertson and Westwood have been especially active in the organization of the new chapter for a number of months. They attended the 1948 Chapter Chairman Conference, held June 28-30 at the Stevens Hotel, Chicago.

Thomas F. Shadwick, Witte Engine Works, Kansas City, Mo., is chapter reporter.

Chapter boundaries encompass an area bounded on the south by a line north of Joplin and Webb City, Mo., and Pittsburg, Kan.; Salina and Hutchinson, Kan., on the west; Atchison, Kan., and St. Joseph, Mo., on the north; and Columbia and Jefferson City, Mo., on the east. The Mo-Kan Chapter will have its headquarters and meeting place in Kansas City, Mo.

## Bureau of Ships Holds Conference Of Naval Foundrymen at Norfolk

DEVELOPMENTS IN NAVAL CASTING were the subjects of a three-day foundry conference, held by the Bureau of Ships, U. S. Navy, at the Norfolk Naval Shipyard, Norfolk, Va., February 8-10, and attended by Naval foundry personnel from as far as Pearl Harbor, Hawaii. Following the conclusion of the regular technical program, those attending the conference were taken on a tour of the Norfolk Naval Shipyard's foundry facilities.

Under the chairmanship of Stanley W. Brinson, master molder of the Shipyard, 13 technical papers were presented and a round-table discussion was held. The papers reported research and development carried on at the Naval Research Laboratory, the U. S. Naval Gun Factory, and the various Naval Shipyards. Subjects included: methods of making radiographically sound castings; grain size control in non-ferrous castings; use of oxygen bearing copper; solidification phenomena; effect of silicon on gun bronze; melting and degasification of gun metal; welding gun metal; using radiography as a foundry control tool; radiographic standards; and insulation of risers to maintain fluidity.

The conference was opened by Captain N. W. Gokey, acting commander of the Shipyard. Following his remarks of welcome, Commander R. H. Lambert, USN, Bureau of Ships, spoke on the Navy's casting research and development program.

Conference planning was headed by Clyde L. Frear, Bureau of Ships. Representing A.F.S. at the three-day meeting was Technical Director S. C. Massari.

## Texas Chapter Plans To Establish Scholarships At Two Texas Schools

TWO FOUNDRY SCHOLARSHIPS, one each at the University of Texas and Texas A & M College will be offered beginning with the 1949 Fall Term, according to plans now being made by the Texas Chapter of the American Foundrymen's Society, it is announced by Chapter Chairman Malcolm J. Henley, Texas Foundries, Inc., Lufkin.

In addition to the proposed two Chapter scholarships, Texas Foundries, Inc., has already established two scholarships at each of these colleges, and the Oil City Iron Works, Corsicana, plans to offer one scholarship at Texas A & M College this fall term.

Texas Foundries, Inc.'s scholarships are offered to foundry students completing their junior year, with the proviso that they will after completing their senior year on the scholarship join the staff of Texas Foundries, Inc., for one year. At the completion of that year, if both the recipient of the scholarship and the company are satisfied with each other, the young man becomes a permanent employee of the company. The first four students, selected in the Spring of 1947, completed their scholarships and are serving their probationary year with Texas Foundries, Inc.

Another project of the Texas Chapter, inaugurated this year, is the practice of securing foundrymen from the Texas area to speak at the Texas A & M Student Chapter's monthly meetings.

# MISSOURIANS DONATE SCHOOL FOUNDRY EQUIPMENT

*Dr. D. S. Eppelsheimer (right) and Instructor James Reynolds of the Missouri School of Mines inspect an electric furnace, part of $7500 worth of equipment given the school.*

A TRUCKLOAD OF MODERN FOUNDRY EQUIPMENT, the gift of St. Louis foundries and Midwestern foundry equipment manufacturers, obtained through the efforts of the A.F.S. St. Louis District Chapter, arrived for installation at the Missouri School of Mines, Rolla, January 12.

The equipment, valued at approximately $7,500, was collected in the last several months by St. Louis District Chapter members in order to enable the School of Mines to offer a practical course in foundry instruction. This foundry course, when set-up in the near future, will be a requisite for graduation from both the Metallurgical School and the Mechanical Engineering School, according to Dr. A. W. Schlechten, head of the School of Metallurgy.

### Chapter Members Visit School

Members of the St. Louis District Chapter, headed by Chairman A. L. Hunt, National Bearing Division, American Brake Shoe Co., arrived with the equipment, visited with faculty members and were guests at the regular monthly meeting of the Missouri School of Mines A.F.S. Student Chapter that evening. Preceding the meeting some 35 faculty members, foundrymen and student chapter officers heard R. B. Parker, assistant to the president, American Brake Shoe Co., speak on *"Planning Tomorrow's Management."*

Speaking at the Student Chapter meeting, Dr. Schlechten stated that the School of Mines has obtained authority to engage a full-time instructor for the course made possible through the generous donations of equipment by manufacturers and foundries. A list of the equipment given the school includes a gas-fired furnace, an arc furnace, a sand mixer, molding machines, flasks, sand, a core oven, patterns and miscellaneous equipment.

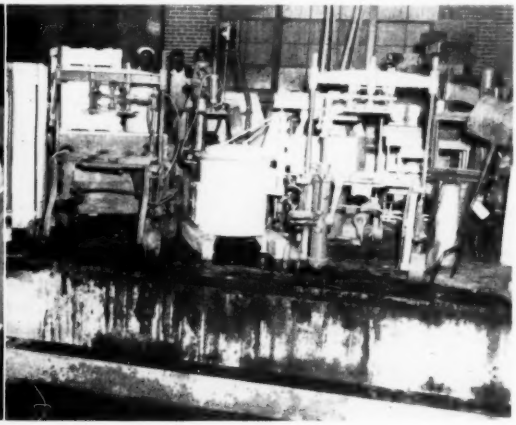
### Foundries, Equipment Firms Contribute

Foundrymen and foundry equipment manufacturers contributing materials or equipment for use in the course at Missouri School of Mines are:

Webb L. Kammerer, vice-president, Midvale Mining & Mfg. Co., St. Louis; Bruce L. Simpson, president, National Engineering Co., Chicago; C. R. Culling, president, Carondelet Foundry Co., St. Louis; Walter E. Illig, vice-president, Banner Iron Works, St. Louis; George E. Mellow, treasurer, Liberty Foundry, St. Louis; Fred B. Riggan, works manager, Key Co., East St. Louis, Ill.; Bram Lewin, vice-president, Lewin-Mathes Co., St. Louis.

Harry Saunders, president, American Foundry & Mfg. Co., St. Louis; Shirley Tiffin, plant manager, Federated Metals Division, American Smelting & Refining Co., St. Louis; E. J. Aubuchon, president, M. A.

*(Left) This group of students and faculty members of the Missouri School of Mines and members of the St. Louis Chapter were on hand January 12 to watch arrival of the foundry equipment shipment (Right).*



Bell Co., St. Louis; Jack L. Stroman, vice-president, Stroman Furnace and Engineering Co., Chicago; Charles W. Rothaar, Application Engineering Dept., Maxon Premix Burner Co., Muncie, Ind.; Albert J. Messmer, president, Messmer Brass Co., St. Louis; and T. W. Pettus, president, National Bearing Division, American Brake Shoe Co., St. Louis.

### Foundries Hosts to Students

On the day following the arrival of the equipment, January 13, Dr. D. S. Eppelsheimer of the Missouri School of Mines, faculty advisor to the Student Chapter; David F. Walsh, assistant professor of metallurgy, and Metallurgy Instructor James E. Reynolds, Jr., in company with some 25 members of the Missouri School of Mines Student Chapter visited St. Louis and were guests of the National Bearing Division of the American Brake Shoe Co. on a plant tour and luncheon. The students spent the afternoon at Liberty Foundry as guests of Student Chapter Industrial Advisor George E. Mellow, company treasurer.

### Students Visit St. Louis Chapter

In the evening the St. Louis District Chapter reciprocated its visit of the night before by inviting the students to attend its regular monthly meeting. Also present at the meeting was Dean Curtis L. Wilson of the School of Metallurgy, who thanked chapter members for their efforts in obtaining equipment for the Missouri School of Mines.

On January 21, A.F.S. National President W. B. Wallis drove to the Missouri School of Mines, in company with W. Pickles of the National Bearing Division, American Brake Shoe Co., to view the equipment and discuss foundry educational projects and the new foundry course with faculty members and students.

# A.F.S. RESEARCH PROJECTS

Research projects of A.F.S. are conducted under definitive contracts with various institutions which have the necessary personnel and mechanical facilities. Reports on each project are required at regular intervals.

"Research" is just that—*search* and *re-search*. It is not like production where reasonably well-known materials, proved methods and engineered designs are employed to turn out salable products. Research commences with an idea and many unknown factors, all of which must be examined by trial and error before the actual idea itself can even be approached.

Months or years may go by before a technique can be evolved which might be expected to shed light on the problem. Finally, a great many tests must be run before the researcher can arrive at useful conclusions. These must be interpreted and further analyzed in terms of actual production for the eventual benefit of the industry.

Results of A.F.S.-sponsored research, when in publishable form, are available to everyone. Quarterly progress reports and visits and consultation with the researchers keep the committees directing the work informed on project developments. Following the lead of the Sand Research and the Heat Transfer Projects, annual reports on the various researches under Society sponsorship will become a regular feature of the Annual A.F.S. Convention and will subsequently be published in TRANSACTIONS OF A.F.S. Some of the annual reports will also be preprinted, some will be available as special publications.

Newest A.F.S.-sponsored research projects were set up following authorization of the general plan by the Board of Directors in July, 1946. First public reports on five projects will be made May 2-5 at the Annual A.F.S. Convention.

| Title of Project | Group Directing Work | Institution |
|---|---|---|
| Hydraulics of Light Metal Flow into Molds | Research Committee, Aluminum and Magnesium Division | Battelle Memorial Institute |
| Fracture Test as an Index of Melt Quality | Research Committee, Brass and Bronze Division | University of Michigan |
| Centrifugal Casting of Light Metal Alloys | Centrifugal Casting Committee, Aluminum and Magnesium Division | Canadian Bureau of Mines |
| Influence of Heredity on Coke Behavior in the Cupola | Cupola Research Committee | U. S. and Canadian Bureaus of Mines, Ford Motor Co., and Eaton Mfg. Co. |
| Fundamentals of Heat Flow During Casting Solidification | Heat Transfer Committee | Columbia University |
| Selective Hardening of Pearlitic Malleable Iron | Research Committee, Malleable Division | University of Michigan |
| High Temperature Properties of Molding Sands | Research Committee, Sand Division | Cornell University |
| Relation of Cores to Hot Tearing | Research Committee, Steel Division | Armour Research Foundation |

# SOUTHERN FOUNDRYMEN HOLD REGIONAL MEETING

**J. P. McClendon**
**Publicity Chairman**
**Birmingham District Chapter**

FOUNDRYMEN FROM 16 STATES heard top technical authorities at the 17th Annual Regional Foundry Conference of the Birmingham District Chapter of A.F.S. held at the Tutwiler Hotel, Birmingham, Ala., February 17-19. Technical highlight of the three-day meeting was the paper *"Nodular Graphite Cast Irons"* presented by C. K. Donoho, American Cast Iron Pipe Co., Birmingham. Four other technical papers presented covered motion study and better foundry methods, dielectric baking of cores, gating systems, and relationship between casting defects and elevated temperature sand properties. Technical sessions were supplemented by visitations to 24 foundries and equipment and supply plants.

### Luncheon, Banquet Feature Noted Speakers

Non-technical meetings included a banquet the evening of the second day, a luncheon the first day and special entertainment that evening. Dr. John M. Gallalee, president of the University of Alabama, spoke at the banquet; Dr. J. T. MacKenzie, Birmingham District Chapter Chairman, American Cast Iron Pipe Co., presiding, introduced him to the 447 "molders of metals" in the audience as a "molder of men." Dr. Gallalee described the development of the foundry department at Alabama and cited the efforts of local foundrymen in furthering the university's foundry work. He commented on the growth of enrollment to nearly double the pre-war student body in explaining current operations at the University of Alabama.

A.F.S. President W. B. Wallis spoke on *"Activities of A.F.S."* at the opening-day luncheon. C. P. Caldwell, Caldwell Foundry & Machine Co., Inc., Chapter Vice-Chairman, presided at the gathering. Mr. Wallis discussed the growth of A.F.S. and the development of regional foundry conferences. Explaining that the Society is an educational and a technical organization he described A.F.S.-sponsored research projects, the educational work of the Society carried on alone and in cooperation with the Foundry Educational Foundation, and the extension of Society activities into the schools through the student chapters. Society service through these activities, and through chapter, regional, and national meetings is accomplished on a budget insignificant in comparison to the six billion dollar value of the industry's annual output.

*The Annual Banquet climaxing the Birmingham Regional Foundry Conference drew 447 founders.*

Of business conditions, Mr. Wallis said he had seen the "flattening out" trend develop in the foundry industry and in others throughout the nation. He believed it was a return to normal rather than the start of a serious recession and suggested that foundrymen take advantage of the lull to review and improve their operations. "It is an opportunity to take stock and get our feet on firmer ground," he said.

### Produces Nodular Graphite Cast Iron

Leading off the Conference, C. K. Donoho described production and properties of nodular graphite cast irons at the first technical session the morning of February 17. National Director T. H. Benners, Jr., T. H. Benners & Co., presided.

Tracing the history of nodular graphite cast iron from the earlier work of British investigators* who used cerium, Mr. Donoho described effects of magnesium additions to molten iron. Briefing his paper which appeared in the February, 1949, issue of AMERICAN FOUNDRYMAN, he told how magnesium and alloys of magnesium with nickel and with copper were used to produce nodular instead of flake graphite in the as-cast condition.

Magnesium in any form added to molten iron may be explosive, Mr. Donoho said. First trials should be made with small quantities of iron with suitable protection for personnel and adjacent flammable structures, he explained.

Among advantages of the magnesium treatment cited was its effectiveness in low carbon, high phosphorous, and relatively high sulphur irons. A ladle addition of a graphitizing inoculant following the magnesium is used to control structure and machinability. Stating that magnesium treated cast irons have

* H. Morrogh, "Nodular Graphite Structures Produced in Gray Iron," AMERICAN FOUNDRYMAN, April, 1948, and A.F.S. TRANSACTIONS, vol. 56, pp. 72-90 (1948).

strength and ductility properties superior to most malleable irons and approaching those of cast steels, Mr. Donoho concluded with a comment on the need for considerable additional development in the field.

Rearrangement of tools and materials for use with minimum effort is the cardinal principle of motion time study according to M. O. Booth, Saginaw Malleable Iron Plant, General Motors Corp., Saginaw, Mich. He spoke at the first Thursday afternoon technical session on *"Progress with Motion Study and Better Methods."* Chairman of the meeting was W. E. Jones, Stockham Valves & Fittings. Mr. Booth described the operations of the better methods department of his plant and explained how it increases efficiency, reduces fatigue and minimizes waste through improved foundry methods.

### Cites New Motion Time Study Methods

W. A. McCarthy, supervisor of standards for the Saginaw Malleable Iron Plant, demonstrated old and improved methods and showed how it is possible to produce more with less effort when motion time study is used to plan the work and work area. Timed by A. H. White, time study expert with Stockham Valves & Fittings, Mr. McCarthy filed, inspected and dipped cores singly at the rate of 785 an hour. Using a fixture permitting two cores to be filed simultaneously Mr. McCarthy filed, inspected and dipped two cores at a time, disposing of one to a plate on either side of his work bench, at a rate of 1485 per hour. Fatigue was less because both sides of the body were used simultaneously. Also demonstrated were the old and improved methods which increased one type of core production from 480 per hour to 780.

### Describes Dielectric Core Baking

Second afternoon session dealt with *"Foundry Core Baking by Dielectric Heating."* J. W. Cable, Thermex Division, Girdler Corp., Louisville, Ky., was the speaker; M. D. Neptune, National Cast Iron Pipe Div., James B. Clow & Sons, presided. Cores are baked in a few seconds to one or two minutes by dielectric heating, said Mr. Cable, in explaining the theory of the process. Molecules of material being heated are distorted millions of times a second and heat is generated in the same way you would expect if a rubber ball were squeezed and distorted rapidly, he said. Although any corebinder can be used most of them require longer to develop strength than is practical in a dielectric unit and the speaker recommended thermosetting synthetic plastic binders.

Cores travel through the dielectric heating unit on a conveyor belt at up to 10 feet per minute and cannot be overbaked. Chills, rods and wires are preferably placed horizontally in the cores to avoid arcing between the upper and lower plates between which the cores pass in going through the electric field. Dowels, toothpicks, and plastic reinforcements, and metal reinforcements which do not extend entirely through the core vertically, give no trouble, Mr. Cable explained. Metal core plates or driers should not be used, he said, but non-conductors, including plywood for plates and castable plastics for driers, may be used.

Some of the advantages of dielectric baking given by Mr. Cable in his paper (to appear soon in AMERICAN FOUNDRYMAN) include: reduction in sand mixing cycle and in number of mixtures; few cores are in process at a time so difficulties can be corrected soon after noted; good collapsability which is inherent in plastic bonded cores.

*D. C. McMahen, left, Harbison-Walker Refractories Co., entertainment chairman, and Fred K. Brown of Adams, Rowe & Norman, Inc., secretary-treasurer of the Birmingham Chapter, relax after the Meeting.*

*"Gating Systems for Castings"* was the subject of a motion picture and talk by W. H. Johnson, Naval Research Laboratory, Washington, D. C., at the first Friday technical session. This was held in the afternoon, following the first round of plant visitations in the morning. Chairman of the meeting was John F. Wakeland, Alabama Foundry Co.

The film showed the results of an investigation to determine the effects of gate design upon the flow and turbulence of liquid steel during pouring. Explaining how photography at 32 and at 1,000 frames a second was used in the study, Mr. Johnson showed that many gating systems do not function as commonly supposed. Pictured were flow in top pouring, whirl gates, riser gates, finger gates, horn gates, step gates and bottom

*At the speakers' table at the Conference luncheon were, left to right, C. P. Caldwell, Caldwell Foundry & Machine Co., Inc., Birmingham Chapter Vice-Chairman; A.F.S. National President W. B. Wallis; Dr. J. T. MacKenzie, American Cast Iron Pipe Co., Chapter Chairman; and A.F.S. Past National President L. N. Shannon, Stockham Valves and Fittings.*

side gates. Originally shown at last year's A.F.S. Foundry Congress and Show, the film is being followed this year by two films on finger gates and step gates to be shown at a joint gray iron-steel meeting at the 53rd Annual A.F.S. Convention in St. Louis, May 2-5.

Concluding technical session of the Conference, on *"Relationship Between Casting Defects and Elevated Temperature Sand Properties,"* had as a speaker Harry W. Dietert, Harry W. Dietert Co., Detroit. Presiding was Howard Nelson, Hill & Griffith Co. The speaker discussed sand control and low cost molding material and explained that to achieve ease in molding the foundryman should: standardize on sand processing and physical properties; maintain good flowability and ramability; and use a permeability which allows for hard ramming.

Castings defects due to sand occur when mold properties are on the extreme low or high side, said Mr. Dietert. Suggesting 20 to 80 psi compressive strength as a basis for discussion, he said to look for dirty castings when the dry strength was below 20. Scabs may be expected if the dry strength at room temperature goes above 80. Best indication of scabbing tendency is high hot strength at 500 F. High 1100 F hot strength with high 1500 F confined expansion foretell rat tails on flat casting surfaces, said the speaker.

Mr. Dietert discussed core control and explained that veining is due to excessive collapsibility. Penetration, except that resulting from a porous core surface, is also related to high collapsibility. Concluding his talk with a color movie, Mr. Dietert showed actual penetration of metal into sand specimens and the effect of mold atmosphere on surface finish.

### Birmingham Regional Conference Committees

Responsible for the Conference technical program were C. P. Caldwell, Caldwell Foundry & Machine Co., Inc., and Sam F. Carter, Jr., American Cast Iron Pipe Co. The Entertainment Committee was headed by D. C. McMahen, Harbison-Walker Refractories Co., with W. G. Bagley, Woodward Iron Co., as co-chairman. Members of this committee, which planned the Thursday evening floor show, the luncheon and the banquet, were: J. R. Reynolds, Hill & Griffith Co.; J. M. Bates, Moore-Handley Hardware Co.; W. W. Hazzard, Kerchner Marshall & Co.; J. T. Gilbert, Stockham Valves & Fittings; and E. M. Whelchel, American Cast Iron Pipe Co.

Morris C. Benners, T. H. Benners & Co., was chairman of the Registration Committee which included Jack Hayes and Fred J. MacReady of American Cast Iron Pipe Co.; Joe E. Keeton, Jr.; Howard Nelson, Hill & Griffith Co.; and Jack Williams, Alabama By-Products Corp. Plant visitations were arranged by Fred S. Middleton, Jackson Industries, Inc., and Dan B. Dimick, Jr., Dimick Casting Co.

Responsible for Conference finances and cited at the banquet for his untiring service to the chapter by Chairman J. T. MacKenzie was Fred K. Brown, Adams, Rowe & Norman, Inc., now serving his sixth year as Secretary-Treasurer of Birmingham District Chapter.

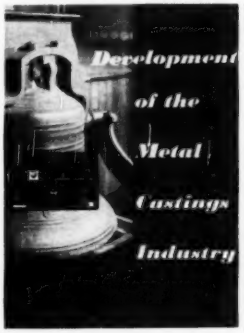
J. P. McClendon and John C. Graham, Jr., both of Stockham Valves & Fittings, handled publicity for the Regional Foundry Conference.

## *"Development of the Metal Castings Industry"* Wins Best Book Awards

"One of the 50 best books of 1948" was the designation recently accorded Bruce L. Simpson's Development of the Metal Castings Industry in a competition sponsored by the American Institute of Graphic Arts of New York. Approximately 10,000 books of all types, ranging from fictional to scientific works were entered in the competition. The contest was based on book design and production.

Development of the Metal Castings Industry, together with the 49 other winning entries, will be on display in the Library of Congress, Washington, and in libraries in New York, Chicago and San Francisco during the month of April.

A second award to Mr. Simpson's book was made recently when the work was voted one of the three best books produced in the Chicago area during 1948 by the Society of Typographic Arts of Chicago at the 23rd Annual Exhibition of Design in Chicago Printing.



Published last fall by the American Foundrymen's Society, Development of the Metal Castings Industry is the result of intensive research and effort on the part of author Bruce L. Simpson who is president of National Engineering Co., Chicago. The 246-page, handsomely-bound volume contains hundreds of illustrations and photographs depicting the history of the metal castings industry from prehistoric times to the 20th Century. The most comprehensive and authoritative work ever written on the art of founding, Development of the Metal Castings Industry is not only highly readable but its beautiful format makes it a valuable addition to every foundryman's library.

## National Founders Association Now Named National Foundry Association

Effective February 10, the name of the National Founders Association was changed to "National Foundry Association"—a move designed to identify the half-century-old organization more closely with the industry it represents.

Headquarters of the Association will remain at 120 South LaSalle St., Chicago, and the organization will continue to deal on a national level with such foundry problems as legislation, taxation, labor relations, etc.

# MAGNESIUM CASTINGS DESIGNED FOR AIRCRAFT ENGINES

**M. H. Young**
**and**
**A. G. Slachta**
**Wright Aeronautical Corp.**
**Wood Ridge, N. J.**

AIRCRAFT ENGINE DESIGNERS are continually striving to reduce the weight-horsepower ratio without adversely affecting the life or safety factor of the engine. Advances in magnesium metallurgy and foundry practice have permitted the aircraft engine designer to utilize magnesium alloys in applications of greater stress than previously possible, with subsequent saving in weight.

Aircraft engines of the reciprocating type have long since established the practicability of magnesium castings in such major parts as crankcase front sections, supercharger housings, and rear sections. These parts are highly intricate in design and well adapted to casting fabrication where function does not permit simplification. Other minor parts such as oil sumps, pump housings, and a variety of covers are made of magnesium on a straight weight-saving basis. Alloys Mg-9Al-2Zn (AMS 4434) and Mg-6Al-3Zn (AMS 4424) in the solution heat treated and aged condition are commonly used for these castings.

The advent of the gas turbine engine for aircraft does not preclude the use of magnesium. Like a reciprocating engine, the propeller turbine requires a nose section for housing the reduction gear, supporting the propeller shaft and transmitting the thrust. On engines of higher power than the conventional piston type, this section becomes quite large and the weight advantage of magnesium material is apparent. Figure 1 is an example of such a casting weighing 250 lb in the as-cast condition. The size and intricacy of such castings require close control and care in foundry practice to produce the quality necessary for aircraft.

### Initial Design

Development of a design for a casting which must withstand for long periods the high alternating stresses produced by the aircraft engine requires close coordination between designer, metallurgist, and foundryman. Shape, size, and weight of the casting are defined by its function as determined from certain requirements of horsepower and weight for the entire engine through a series of calculations and analyses. The shape of the crankcase front section shown in Fig. 2 is defined by the section to which it is bolted, the reduction gear system it must enclose and due consideration of all dynamic loads acting upon the part. In general, these loads are produced by the following three principal operations:

(1) Take-off at rated power and speed—The loads considered here are those generated by combustion in the cylinder assembly and transmitted through the power section to the reduction system, which in turn transmits the load through the propeller shaft to the propeller.

(2) 12*g* Pull-out—Loads acting on the engine when the plane is pulled out of a dive.

(3) Radians per second spin—Loads acting on the engine when the plane is in a spin.

After maximum loads at the various critical locations are established and the material selected, the permissible stress level is determined by adjusting the section thickness and/or by addition of supporting

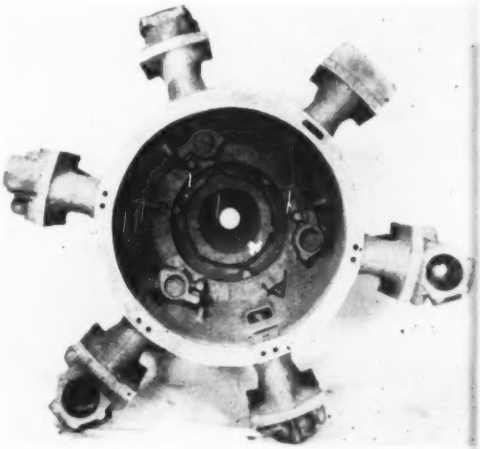


*Fig. 1—This large experimental magnesium casting, weighing 250 lb as-cast, requires close foundry control.*

*Fig. 2—Typical aircraft engine crankcase front section. Note rounded recessed corners and generous radius at base of the governor drive pad. Compare with Fig. 7.*

**Preprint No. 49-29.** This paper will be presented at an Aluminum and Magnesium Session of the 53rd Annual Meeting, American Foundrymen's Society, at St. Louis, May 2-5, 1949.

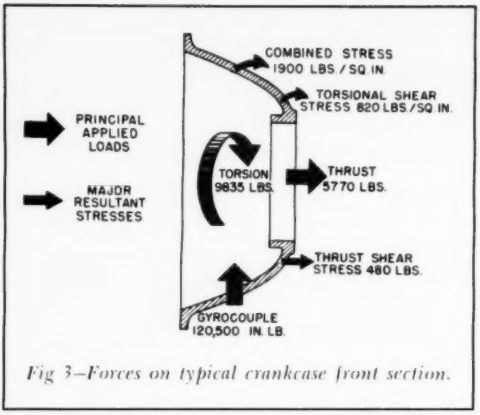



*Fig 3—Forces on typical crankcase front section.*

members. The stress level selected for an initial design is primarily governed by experience gained from the successful operation of other castings of a type as similar as possible to the new design. In some magnesium castings, depending upon casting quality, a steady stress near the yield point is permissible.

The principal applied loads and major resultant stresses acting on a typical crankcase front section are shown in Fig. 3. Here, the stress level is controlled by section thickness such that the combined unit stress is 1900 psi. This is well below the yield and fatigue strength of the material selected.

### Keep Stresses Within Safe Limits

Equally important with the steady stresses produced by engine operation are the tensile pre-stresses resulting from mechanically attaching components. Since these two stresses may be additive, precautions must be taken to keep the combined level within safe limits. Unless stress raisers are minimized in design and unless the casting can be produced to a consistent aircraft quality level, the design is doomed to failure. Coordination between the design engineer, metallurgist, and the foundryman at the initial design stage is imperative.

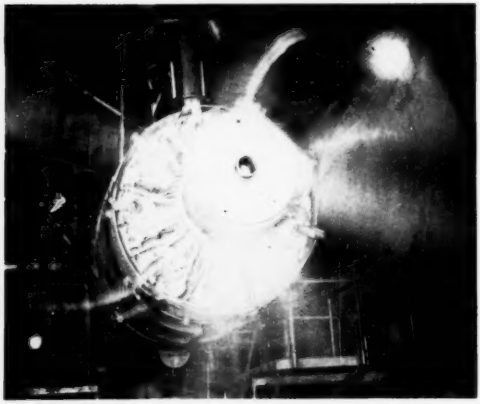


*Fig. 4—Experimental engine in operation on test stand.*

An engine designer must guard against such stress raisers as:

(1) Sharp edges, corners, and fillets
(2) Abrupt section changes
(3) Thin walls and improper tolerances

The foundryman must guard against:

(1) Core shifts
(2) Excessive flash or surface roughness in areas difficult to inspect or clean
(3) Hidden core wires
(4) Microshrinkage and porosity
(5) Cold shuts
(6) Improper heat treatment

### Proving Initial Design

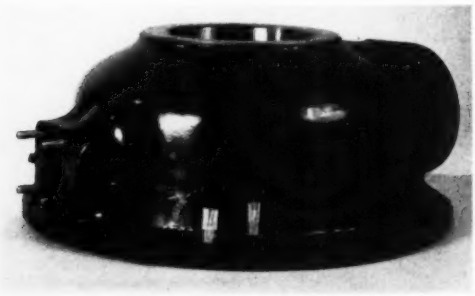
Upon completion of the initial design stage, castings are founded to try out castability. Investigations by x-ray and fracture show up possible microshrinkage, porosity, or cold-shut areas. Improvements, as indicated, are instigated in founding practice until an acceptable casting is provided for proving the initial design. Proof testing is accomplished by:

(1) Static Test
  Stress paint
  Electric strain gages
(2) Dynamic Test
  Experimental engine operation
  150 hr model test

Static testing generally confirms or refutes theoretical static stress calculations. The advantage of this type of testing is that it is non-destructive and can be applied to full-scale engine parts independently of an assembled engine. It also permits discovery of obvious under- or overdesigning before the part is subjected to engine testing. Lightening of the part in low-stress areas can be effected at this time.

The two test methods, brittle lacquer and electric strain gage, are at times used in conjunction with each other; the brittle lacquer to indicate maximum stress areas and the electrical strain gages to evaluate the actual stresses at selected areas as indicated by the lacquer tests. Static testing is useful to bridge the gap between theoretical results based on simple statically loaded structures and actual static stress distribution in complex engine structures, but it will not locate nor indicate the maximum alternating stresses that are the cause of most engine failures in service.

*Fig. 5—Electric strain gages mounted on crankcase front end section of aircraft casting for stress testing.*



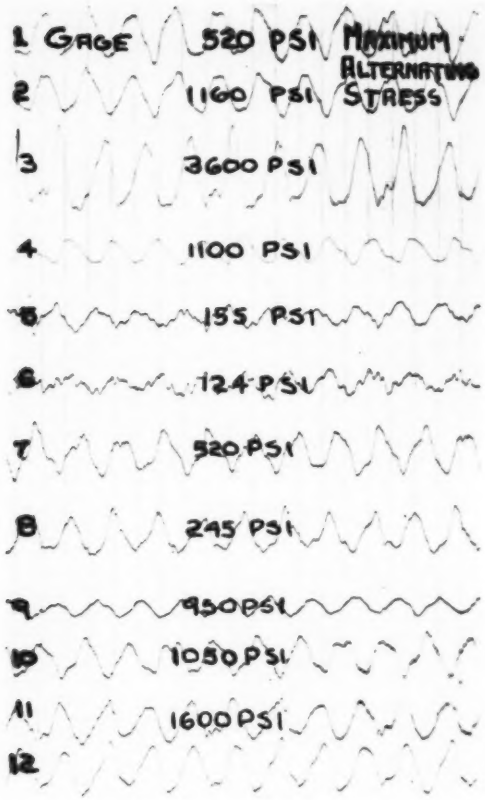



*Fig. 6—Photographic record of gage signals and alternating stresses at 12 locations on a magnesium aircraft crankcase front section casting undergoing test.*

*Fig. 7—Crankcase front section showing sharp protruding corners and fillet at base of governor drive pad.*

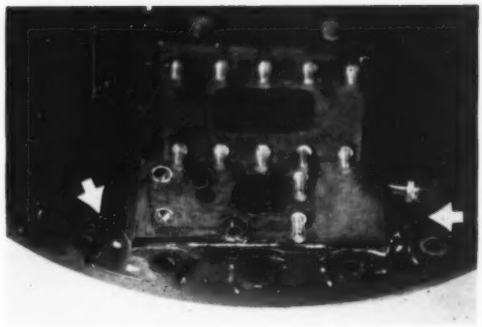
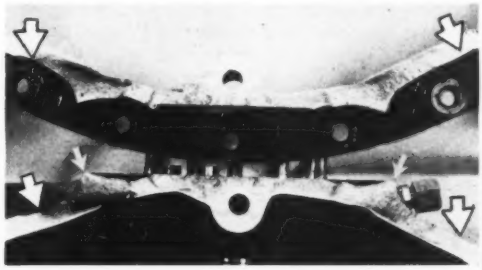


*Fig. 8—Blacklight photograph showing exterior view of crack in the crankcase front section casting shown in Fig. 7. White arrows indicate the extent of crack.*

*Fig. 9—Fractured surfaces of crack in crankcase front section. Extent of crack is indicated by large white arrows, and fatigue nuclei by the small white arrows.*



Failure of a material from repeated loading is not accompanied by appreciable yielding. It is usually a gradual or progressive fracture which starts at some point in the material where the stress is much greater than the calculated stress. At this highly localized stress region a small crack may start and gradually spread, as the stress is repeated, until the whole member ruptures. The apparent loss of strength of a material due to repeated stress is called fatigue, and it occurs even when the calculated unit-stress is less than the proportional limit of the material.

Laboratory fatigue testing will indicate the superiority of one material over another, but actual full-scale dynamic testing is necessary to locate the area most susceptible to fatigue. If x-ray or fracture shows microshrinkage in this area the casting is subject to rejection. Such an area remains a critical one during subsequent quality checks and corrective foundry measures must be taken to eliminate or reduce the microshrinkage.

Dynamic or full-scale engine testing is the next logical step in the evolution of a new design. Here, the part is subjected to a most rigorous fatigue machine, the engine itself. This testing is usually performed on experimental engines which may incorporate one or more new design parts. Figure 4 shows an experimental aircraft engine in operation with a flight propeller.

Electrical strain gages applied to engine components

during experimental operation permits fairly good determination of alternating stresses in critical areas and the conditions which give rise to these stresses. This information allows redesign to be approached from one or more directions. The part may either be redesigned to lower the stress level in the critical area, or engine operating condition may be altered to correct the stress concentrations.

The value of electric strain gage testing can best be illustrated by its use in evaluating a newly designed torquemeter crankcase front section under actual engine operating conditions. Since difficulty was experienced with the previous design, it was desired to determine the vibratory stresses, resonance peaks, modes of vibration and sources of vibration excitation in the new part under varying engine speeds and torque conditions.

Twelve electric strain gages were placed at various locations on the part. These locations were previously determined as the points of maximum stress by stress paint tests. Figure 5 shows how electric strain gages are located on a crankcase front section. Figure 6 shows the photographic record of the gage signals and alternating stresses at each of the 12 locations. The results of this test showed that the crankcase front section stresses were predominantly caused by a resonant condition in which the propeller shaft "whirled" around its center of rotation at twice engine speed in the direction of engine rotation.

The exciting force for this mode of vibration was found to be an engine second order unbalance. The resonance peak occurred at 1650 rpm and the maximum vibratory stress was 3600 psi. The presence of a resonant condition and high alternating stresses showed the need for second order balancer which would eliminate this excitation and greatly reduce the crankcase front section stresses. In this case the elimination of the exciting force giving rise to the resonant condition, rather than increasing the weight of the part, was the logical solution to the problem.

Proof testing of parts incorporating major design changes is not complete until the parts are subjected to a model test of 150 hr. This test, designed to stimulate actual operation, determines the endurance of a design under imposed stresses for long periods of time. Parts are not released to production until a successful model test has been completed.

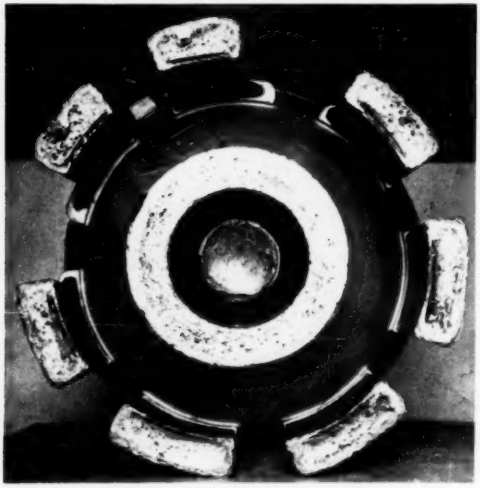
### Correcting Design

After an engine is in production design changes are often necessary to improve operation and life or to correct some fault that was not at first obvious. Founding practice is usually established before a part goes into production, but occasional design changes are inaugurated at a later time to facilitate founding technique or to improve quality. The following illustrations are cited as examples of design correction:

During development testing of the Model 14 engine, failures of the crankcase front sections were reported after 219 and 395 hr of testing time. Analysis of the failed parts revealed that they failed in fatigue from nuclei located in the sharp corners at the base of the governor drive pad (Figs. 7, 8, and 9). The similarity of the failures and the satisfactory quality of the casting material definitely indicated a need for a design change. Crankcase front sections, with rounded recessed corners and liberal radii in the highly stressed areas of the governor drive and oil sump pads (Fig 2) were fabricated and engine tested. This design change eliminated subsequent failures.

Serious oil leakage caused by microshrinkage in oil passages in the rear wall of a Model 18 crankcase front section casting was encountered on a 1000 psi hydraulic test. To eliminate this condition it was necessary to change the casting method. One of the salient features of the improved method was the introduction of a solid

*Fig. 10—Propeller end view of casting on crankcase front section. Riser feeding rear hub is in center.*



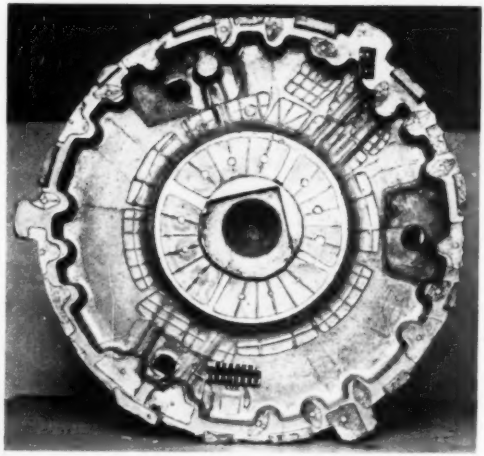
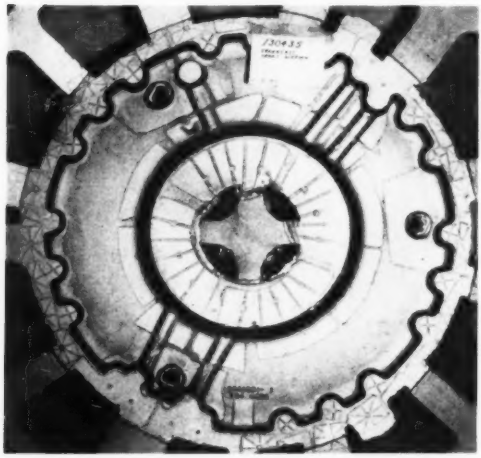


*Fig. 11—Anti-propeller end view of same casting (Fig. 10) showing the rear hub and solid base of the riser.*

central riser shown in Figs. 10 and 11, as compared to the previous four-segment riser shown in Fig. 12. It can be readily seen that the effective feeding area of the risers into the critical hub was increased approximately threefold.

Use of a solid riser was made possible by relocating the support of the large core, which formed the casting cavity, to the three oil drainage holes in the web wall. Past practice was to support the core by means of the core portions located between the riser segments

*Fig. 12—Anti-propeller end view of casting showing the four-segment riser used prior to design change. The internal core was supported by a four-pronged core print located between the riser segments.*



and employ the parts of the core which formed the oil holes merely as stabilizers. To provide adequate support it was necessary to enlarge the oil drainage holes. At the time the foundry design change was requested a lightening program was in process, with the result that additional holes were made in the web wall. The five large holes (Fig. 13) are now being used as core print holes to support the large internal core.

### Metallurgical and Quality Control

Aircraft standards dictate that castings conform to specifications for composition, mechanical properties and established internal soundness requirements. As previously mentioned, magnesium castings of the size and shape described here are susceptible to microshrinkage, and castings completely free of this defect are difficult, if not impossible, to found. The degree of microshrinkage that can be tolerated in a casting is dependent on the application. The permissible microshrinkage may vary within an individual casting with the stress distribution encountered during engine operation.

High stress areas must be practically free from microshrinkage. Each foundry operation must be closely controlled to insure a high quality, uniform product. All castings should be subjected to 100 per cent x-ray

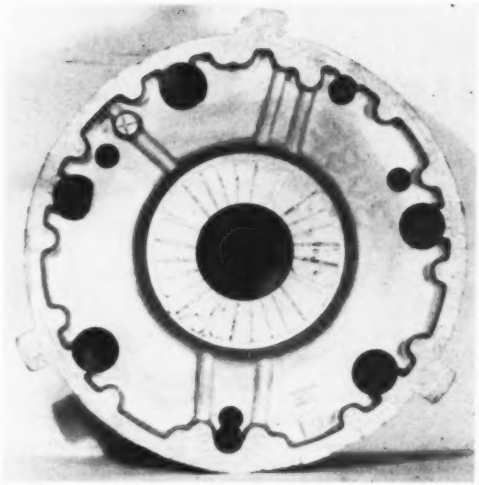


*Fig. 13—Present casting design with additional holes in web wall. The large holes are now being used as core print holes to support the large internal core.*

examination until such time as it is evident that the foundry method is producing the desired quality, after which the x-ray examination may be reduced to a percentage check.

Successful performance of magnesium castings in aircraft engines depends upon proper design and good foundry practice. Past success is evident from the many hours of accumulated service time on a variety of engines. Continued good design and foundry practice should assure a vital role for magnesium castings in the large gas turbine aircraft engines now being developed. The size and intricacy of such castings will offer a real challenge to foundrymen to produce the quality on which the designer has become dependent.

## Aluminum Association Elects 1949 Officers At Three-Day Annual Meet

NEW OFFICERS AND DIRECTORS of The Aluminum Association, elected at the Association's Annual Meeting, held January 18-20 in New York, are:

*President*, R. S. Reynolds, Reynolds Metals Co., Richmond, Va.; *Vice-Presidents*, E. G. Grundstrom, Advance Aluminum Castings Corp., Chicago; M. E. Rosenthal, United Smelting & Aluminum Co., Inc., New Haven, Conn.; and George Wright, The John Harsch Bronze & Foundry Co., Cleveland. A. V. Davis, Aluminum Company of America, New York, was re-elected Chairman of the Board, and Donald White was re-appointed Secretary-Treasurer.

*Directors-at-large* to serve three years are: Frank B. Cuff, Aluminum Company of America; R. G. Farrell, New York, of Fairmount (W. Va.) Aluminum Co.; and W. A. Singer, Apex Smelting Co., Chicago.

George N. Wright of The John Harsch Bronze & Foundry Co., Cleveland, was re-elected chairman of the Foundry Division.

# RISERING CASTINGS

**J. B. Caine**
**Metallurgist**
**Sawbrook Steel Castings Co.**
**Lockland, Ohio**

**The official Exchange Paper from the American Foundrymen's Society to the French Foundrymen's Association was presented at the 22nd French Foundry Congress, held in Paris, October, 1948.**

DUE TO THE INFINITE VARIETY of shapes cast, risering has always been considered a practical problem, one to be approached empirically. The objection raised to scientific control because of the great variety of shapes that must be risered is illusionary.

Risering can be separated into two phases, positioning and dimensioning. Quantitative data on each phase, derived from relatively simple shapes, can be applied to any casting, no matter how complex. The derivation and application of these fundamental quantitative data is of practical importance, not only in increasing quality but in decreasing cost.

### Positioning Risers

Solidification shrinkage is a manifestation of a phase change, exactly the same type of phase change that occurs at lower temperatures and determines heat treatment and physical properties. Those phase changes occurring when the metal is solid are recognized as being amenable to scientific approach and control. There is no reason why a similar phase change occurring when the metal solidifies cannot be studied and controlled from the same scientific standpoint. Nevertheless, solidification shrinkage and risering are regarded as being out of the field of the laboratory and are treated in the foundry as practical problems.

Because solidification shrinkage is the result of a phase change when the metal cools from the liquid to the solid state, the same laws apply for any metal. Variations due to the metal are differences of degree, not of kind. Therefore, a fundamental study of this phenomenon need not be too concerned with the different kinds of metal cast, such fundamentals applying equally well to any metal.

The technical literature of the foundry industry abounds in papers treating gating and risering as an art, describing risering procedures for definite castings. These procedures, unfortunately, are not applicable to even similar castings differing slightly in only one or two dimensions. It is hoped that this paper, treating gating and risering from an entirely different point of view, will stimulate interest and discussion in the science of risering.

Before going into the details of solidification shrinkage and the occurrence of defects attributal to this shrinkage in castings, just what are they? They are due to that contraction in volume occurring while the metal is cooling from the pouring temperature down to the liquidus line of the equilibrium diagram (the beginning of freezing), and especially due to contraction occurring between the liquidus and solidus lines, as the metal is freezing. Contraction after the metal is solid does not result in voids, but in overall change in dimensions (patternmaker's shrinkage).

Although a rigorous study of volume contraction on solidification must take into consideration liquid, solidification and solid shrinkage simultaneously, our sketchy knowledge allows simplification of presentation in considering each one as a separate entity. In the future, a simultaneous more accurate treatment will be in order, but this must await further knowledge of the individual phenomena.

As far as risering is concerned, only the first two types of volume contraction need be considered. In some cases liquid shrinkage must be taken into consideration, but by far the most important phase is volume contraction occurring during solidification.

### Diagraming Riser Systems

Any risering system, no matter how complex, can be diagramed as shown in Fig. 1. Complexity in the casting being risered merely increases the number of systems. The sections shown can be of any size, can be reversed or turned at any angle, or curved rather than straight; as far as risering is concerned it is the same system. Therefore, if the fundamentals of solidification shrinkage and risering are known for this simple system they can be applied to any casting, no matter how complex.

Another point not generally appreciated is that a risering system is always composed of relatively simple shapes—cylinders, squares, parallelopipeds—and that even the most complex casting is composed of combinations of these relatively simple shapes. Therefore, if the shrinkage characteristics of simple shapes in a simple risering system, as shown in Fig. 1, are known quantitatively for any metal, this knowledge can be applied to efficiently position and dimension the risers for the most complicated casting.

Another simplification can be made for the different metals that must be risered. The exact shrinkage cavities shown in Fig. 1 and the examples to follow are those found in steel castings. Steel has been chosen not only because the writer is more familiar with this metal, but primarily because shrinkage voids are accentuated in steel and are the most useful for illustrative purposes.

It must be emphasized that fundamentally the same changes occur with other metals on solidification. Per-

haps, due to a lower volume contraction on solidification, the voids are not as large as found with steel. Perhaps, if the metal solidifies over a greater temperature range than steel the voids will not be as definite, but these are differences in degree, not of kind. If the alloy is cast at a lower temperature, the temperature gradients and rate of skin formation may be so low as to throw the shrinkage cavity from the center (as illustrated for steel) to the surface.

The difference again is one of degree, not of kind. The castings will all show shrinkage voids, some with a large void as illustrated for steel, others with a depression in the cope surface, as found many times in iron and the light alloys, or perhaps the shrinkage voids will be dispersed, resulting in metal of low density, a defect plaguing the non-ferrous foundryman. All are manifestations of the same phenomenon, solidification contraction resulting from the phase change from liquid to solid, and the elimination of all these defects is governed by the same basic laws.

If no provision is made to furnish liquid metal to the system illustrated in Fig. 1*a* as it is undergoing solidification contraction, and steel is introduced into the thin section so that the temperature gradients in both ends are the same, shrinkage voids will be encountered as shown in Fig. 1*a*. Note that the voids are not in the geometric center of the heavy sections, but at the thermal center. This is due to the fact that the rate of heat extraction is restricted at the re-entrant angles where the thick and thin sections join.

Metals other than steel will show the same fundamental shrinkage characteristics, even though at first glance the shrinkage voids observed on sectioning the casting seem to be entirely different. The only differences are the mode of solidification, the amount of contraction on solidification and the temperature gradient as influenced by the pouring temperature.

### Solidification Contraction

If the metal cast into the system has a low solidification contraction the voids will be smaller than those shown for steel, and if the riser system is small, especially in section, there will be no voids from the practical standpoint. However, voids can be found if the inspection is sufficiently precise. If the metal being cast into the system has a high solidification contraction but, due to a longer freezing range between the liquidus and solidus lines of the phase diagram, the mode of solidification is such that the shrinkage voids are dispersed, no definite voids will form, but the metal will exhibit a lower density than normal, so-called open-grain or microshrinkage.

In all cases, no matter which type of shrinkage voids are formed, the only method of control and elimination of these voids is to provide reservoirs of liquid metal, so positioned and proportioned that they will furnish liquid metal to the system until it solidifies. If an adequate reservoir or riser be introduced into the system (shown at *A* in Fig. 1*b**) and the system filled with steel through the riser, to eliminate for the moment complications due to the gate, that part of the system at *A* will be free from shrinkage cavities.

However, the same shrinkage cavity will still exist at area *B* in Fig. 1*b*. Again, for other metals the shrinkage cavity or cavities at area *B* may not be as large or as discrete as illustrated for steel, but they will exist. Their severity depends on the mode of solidification, temperature gradients as influenced by the pouring temperature of the metal, and the amount of solidification contraction, all differences of degree, not of kind.

The point illustrated in Fig. 1*b*, that shrinkage away from the riser is influenced very little if at all by the riser, needs emphasis, for it is overlooked too many times in the foundry. The rate of solidification of

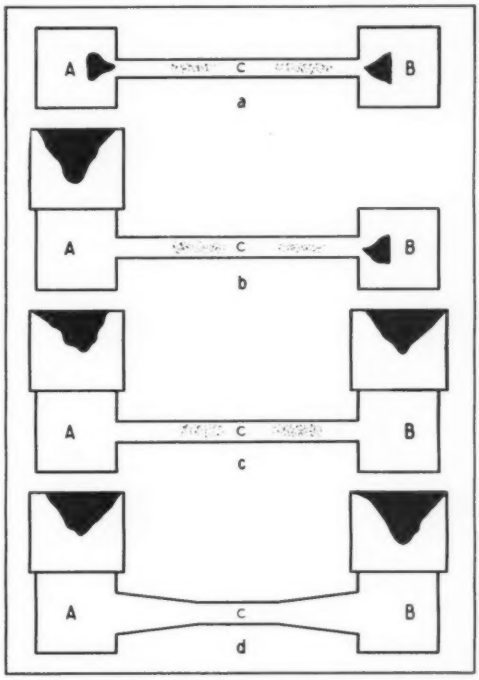



*Fig. 1—Diagrams showing methods of eliminating three types of shrinkage encountered in risering systems.*

the thinner member is so high that it effectively cuts off any flow of metal from the riser to the opposite heavy section even before it (the thin section) is completely solid.

Pressures necessary to force liquid metal through the dendrites of even a partially solidified section are measured in hundreds and thousands of pounds per square inch; pressures that cannot even be approached by hydrostatic pressure attained with even extreme riser heights. It is necessary to place another reservoir or riser on the other heavy section at *B*, as shown in Fig. 1*c*. Both heavy sections are now fed and are sound.

In steel and many other metals another complication

* Top open risers are used to illustrate this system for the sake of simplicity of presentation. Top blind, side blind, or side open risers can be used, the only difference being a possible change in the size of the risers, a subject to be discussed later in this paper. For metals other than steel the riser size will change, but not the riser itself. This point also will be discussed later.

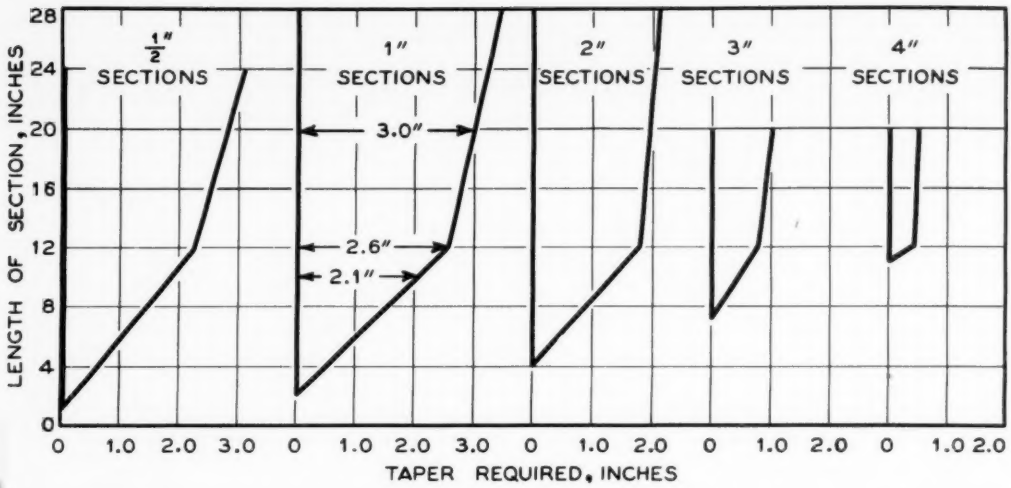



*Fig. 2—Taper required to obtain freedom from dispersed shrinkage in steel castings (Brinson and Duma[1]). Amount of taper required for any section height and thickness is equal to horizontal width between the lines in inches, as illustrated for the 1-in. section.*

arises, if absolute solidity is required, in that dispersed shrinkage is encountered in the uniform section, as illustrated at area *C* in Fig 1*c*. In steel this type of shrinkage is known as centerline shrinkage. Information obtained from work done on this type of shrinkage in steel should be of particular interest to the non-ferrous foundryman, for this type of shrinkage is quite similar to microshrinkage in the light alloys, open grain in iron and non-ferrous alloys.

Many times the individual voids of dispersed shrinkage are so small that they cannot be seen until the section is deep etched. The importance of this type of shrinkage should not be judged by the size of the voids, for their effect on the physical properties of the casting can easily be greater than a discrete visible shrinkage void many times the size of the individual voids of dispersed shrinkage. The user of castings is becoming aware of this fact, and the elimination of this type of shrinkage assumes increased importance.

### Temperature Gradients

Dispersed shrinkage of this type is found in steel in uniform sections where the temperature gradients are relatively low. At changes in section, where the temperature gradients are higher, steel will freeze soundly from the surface to the hottest area, liquid steel filling all the voids that form in the solidifying metal until finally there is no more liquid metal left and a definite and relatively large void is formed.

Temperature gradients for any given shape become less as the pouring temperature of the alloy being cast decreases and the tendency for dispersed shrinkage increases. This condition is aggravated if the alloy being cast has a long freezing range and forms longer dendrites of solid metal during solidification, these long dendrites cutting off the flow of liquid metal to that metal that is almost but not completely solid, so that innumerable shrinkage cavities are formed between the dendrites. Dissolved gases can also aggravate this condition.

The mode of solidification of any particular alloy cannot be changed, but much can be done to change the temperature gradients in the risering system to at least minimize the amount of dispersed shrinkage. Any method that will promote directional solidification, that is, solidification from the area most remote from the riser, progressively to the riser will minimize or eliminate dispersed shrinkage. Unfortunately, most methods that will promote directional solidification conflict in some way with other requirements of the gating system, or with the most efficient method of making the casting.

One method of eliminating dispersed shrinkage in steel, which has been studied extensively by Brinson and Duma[1], is that of tapering the section. Fig. 2 summarizes their findings and shows the amount of taper required to eliminate dispersed shrinkage in any given steel plate section up to 4 in. thick. Dispersed shrinkage is not found in uniform steel sections over 4 in. thick. Although the values given in Fig. 2 can be used directly only for steel, they should be of interest to the foundryman casting other metals as a guide in the study of this method of eliminating dispersed shrinkage in his particular alloys.

Therefore, in order to insure freedom from all three types of shrinkage, that at the riser, shrinkage away from the riser in a heavy section, and dispersed shrinkage, the system should be risered for steel and tapered as shown in Fig. 1*d*. The same fundamentals apply for any metal.

It should be pointed out that the Brinson and Duma results can be used with assurance only for platelike sections that are solidifying from only two surfaces. If the section is square, rectangular, or is short and an appreciable amount of solidification is occurring from more than two surfaces, the tapers recommended by Brinson and Duma may or may not apply.

Although the tapering method advanced by Brinson

and Duma is simple and foolproof, it can be prohibitively expensive, especially if the taper must be removed from the casting because of design considerations. Therefore, any gating and risering method that does not involve a change in the dimensions of the casting section itself will be more practical, even though it does not insure complete freedom from dispersed shrinkage.

Dispersed shrinkage can at least be decreased by introducing the metal into the risers to insure the coldest metal away from the risers, the hottest metal in the risers. If top risers are used there are a number of objections to this method. The tendency toward sand defects is increased due to the erosive action of the metal dropping from a height, but in many cases it is advantageous to use a more expensive sand that will resist the additional erosion if dispersed shrinkage can be minimized by top gating (Fig. 3*a*).

However, the most serious objection to top gating is the turbulence set up by the falling metal. This turbulence interferes with the proper directional solidification of any metal, with increased dispersed shrinkage resulting. With the more reactive metals such as the bronzes, aluminum and magnesium, no turbulence at all can be permitted because of gas absorption and the formation of oxide films. Some type of bottom gating is mandatory, as shown in Fig. 3*b*, even though introduction of metal into the bottom of the casting creates the most unfavorable temperature gradients for directional solidification.

### Step Gating Requires Careful Design

The so-called step-gating system, as shown in Fig. 3*c*, which had long been thought to promote better temperature gradients in the section, has been shown recently[2] to be largely ineffective unless the gating system is carefully designed and the flow of metal into the gate closely controlled. Unless these conditions are met, most if not all of the metal still enters the bottom gate. No quantitative information is available at present on the proper design of a step-gating system.

Many ingenious methods have been advanced to overcome these difficulties and introduce the metal into the mold with the minimum amount of turbulence and still obtain proper directional solidification. Elliot and Mezoff[3] describe some novel procedures for magnesium, and in one instance show a risering system for a cluster of small castings that could be used almost without change for steel.

An ingenious method of eliminating or minimizing dispersed shrinkage has been advanced by Taylor and Rominski[4] which, because of its simplicity, should provoke thought and additional work in all metals. The casting or section is gated and risered from the bottom, using blind risers with provision for introducing atmospheric pressure into the riser[5], as shown in Fig. 3*d*. As the mold is filled from the bottom there is a minimum amount of turbulence; the coldest metal is forced to that part of the casting farthest from the riser, and as perfect directional solidification obtained as is possible with a uniform section.

### Control Directional Solidification

Taylor and Rominski[4] have shown that a section one in. thick and 12 in. high can be fed in steel with no dispersed shrinkage. If the section is gated and risered from the top, appreciable dispersed shrinkage is found in the same test piece. A 2-in. section can be fed vertically to a height of 24 in. by the judicious use of chills.

Many variations of the Taylor and Rominski method should be investigated, even for steel. One is the effect of variation in section, as the published information is restricted to uniform sections. For example, can the fundamental risering system illustrated in Fig. 1 be risered in this manner, eliminating the tapered uniform section, if cast vertically with a blind riser at the lower heavy section, gating into this riser, and a top open riser used to feed the upper heavy section? Can the system be cast horizontally and, if not, what is the minimum angle necessary for non-turbulent flow

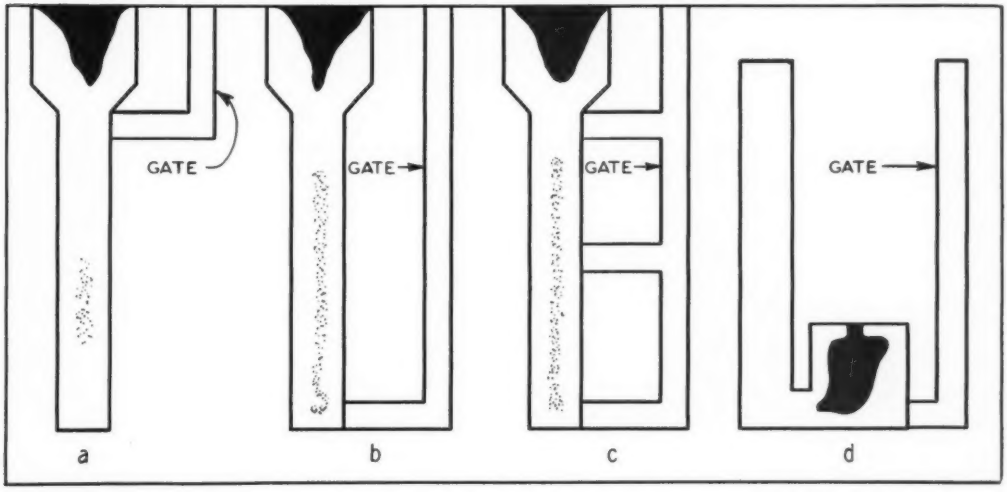



*Fig. 3—Gating method effect on dispersed shrinkage.*

and elimination of dispersed shrinkage? Quantitative data on these questions will pay dividends in higher quality and decreased costs, not only for steel but for all metals.

Another phase of risering must be mentioned—chilling. Many of the mysterious failures and successes involved in the use of ferrous chills with steel castings have been solved by Troy's[6] investigation. He has shown that an adequate ferrous chill, one that is not saturated with heat before the section being chilled freezes, will cause solidification at a rate 2½ times as fast as will sand. This means that a risering system such as illustrated in Fig. 4*a* cannot be chilled in steel, for the heavy section is more than 2½ times the thickness of the thin section and even if chills are used it will freeze more slowly than the thin section.

All that the chill will accomplish in this instance is a slight decrease in the size of the void and a change in its position. This point is continually overlooked in the foundry. It is impossible to feed a casting by chilling alone. A source of liquid metal is still required. All that a chill accomplishes is to make it possible to distribute liquid feed metal to areas which otherwise could not be fed without another riser. Distance and section size are definite limiting factors when chills are used.

If the dimensions of the risering system of Fig. 4*a* are changed slightly so that the heavy section away from the riser is less than 2½ times as thick as the thin section connecting the two heavy sections, the heavy section away from the riser can be fed through the thin section and this risering system fed by one riser, with a considerable saving in production, as illustrated in Fig. 4*b*.

The foregoing is a good example of the practical usefulness of fundamental quantitative information, even if specific castings are not discussed. Such quantitative information can be applied to any specific casting. Much more such information is sorely needed on all phases of risering. Exact quantitative data are needed, for what seems to be an insignificant change in one dimension can completely change the risering of a casting in production.

### Many Chill Applications

It is probable that the exact values just given for the chilling of steel cannot be used directly for the other metals, but the differences will not be large. Of course, in iron practice the use of chills in direct contact with the casting is impossible in many cases because of the chilled surface. Another interesting speculation is the use of chills made of a metal with a high heat capacity and conductivity, such as copper. The use of such metals may enlarge the field of chill applications. There are many other applications of chills than that illustrated—one will be discussed later—which are specific conditions. However, details have no place in a fundamental discussion.

A variant of the fundamental risering system shown in Fig. 1 is a uniform section, too long to be fed by one riser. In steel, dispersed centerline shrinkage will be found between the risers in such a uniform section if the risers are too far apart. The same type of shrinkage, varying only in degree, will be encountered in all metals. In some cases chilling or tapering can be resorted to in order to minimize or eliminate this difficulty, but in most cases the solution is the use of additional risers more closely spaced.

Effective feeding distance is one of the most important risering problems, and one on which the least information is available. Lack of knowledge affects all phases of risering—placement, number, and even the size required. Admittedly, the problem is quite complex, but it is so important that quantitative information must be obtained as soon as possible. Any effort will be well spent, for the feeding range of a riser must, at present, be guessed at whenever a casting is risered for production. A wrong guess means either too many risers, with excessive cutting and grinding costs, or too few risers and a defective casting.

An important special application of chills on uniform sections is that of chilling a point between risers to insure that each riser will feed that portion of the section it is intended to feed. Much of the reason for the use of chills in this instance is due to lack of knowledge of the feeding range of a riser. This use of chills can become quite important if the risering system is at an angle to the horizontal, or if vertical and one riser is at a higher level than the other.

Cases are not uncommon in which the top riser not only feeds the whole system but also the lower riser, with severe shrinkage resulting at the upper riser because it was designed to feed only part of the system. A well-placed chill will eliminate this danger.

### Riser Proportioning and Dimensioning

So much for the first part of this paper, that having to do with the placement of risers. It is admitted that the first part is not only sketchy, but also elementary. This is due mostly to our elementary knowledge of the subject. The missing knowledge is, in the writer's opinion, the most serious and important gap in foundry technology. More fundamental quantitative information is available on the second phase of risering—that of determining the proper proportions and dimensions of a riser which is to feed a given casting or section[7].

Before entering into the detailed discussion, it should be emphasized that as far as practical risering is concerned the subject can be divided into two phases—that of positioning the riser as discussed previously, and that of dimensioning the riser, the subject now under discussion. It should be fundamental in risering practice that shrinkage in areas remote from the riser has nothing to do with the riser, and that the riser and that part of the casting within the feeding range of the riser should be considered a complete risering system. No matter how complicated the casting, no matter how many risers are required, each riser and that part of the casting within the feeding range of the riser should be considered a separate system.

Although this phase of risering can become quite theoretical, its practical importance cannot be too strongly emphasized. The problem now is to find a method of determining the smallest riser that will feed a given casting or risering system. The commendable tendency in the foundry today is to over-riser to insure quality. A method which will permit

the use of smaller risers and still maintain quality can be translated directly into lower costs due to increased yield. As will be shown later, the increase in yield possible with a metal with a high solidification shrinkage such as steel is substantial. Similar savings are possible with other metals.

Only one type of shrinkage is of interest now, that occurring at, or immediately adjacent to the junction of the casting and riser. If the riser is improperly proportioned it will either drain out completely or solidify too quickly, furnishing insufficient feed metal, and shrinkage at or adjacent to the casting and riser junction will be found.

One important exception to the preceding statement should be mentioned. A riser has a function other than furnishing liquid feed metal to the solidifying casting, that of supplying sufficient hydrostatic head. Shrinkage defects, whether surface or subsurface, due to lack of hydrostatic head may be quite distant from the riser, for this type of shrinkage cavity occurs early during the solidification period, when much liquid metal is present in the system and the feeding range of the riser is quite large.

### Appearance of Shrinkage Cavities

Shrinkage defects due to lack of hydrostatic head can be quite puzzling in production, for their appearance is dissimilar to the other types of shrinkage defects. As they occur early during solidification, many times when only a thin shell of the section has solidified, they have the appearance of cavities due to entrapped gas rather than shrinkage cavities. However, riser dimensions other than height have no bearing on this problem; in fact, all that is necessary is that the gate be of sufficient height, and the riser can then be made as short as desired.

As far as riser dimensions are concerned, knowledge of the exact feeding range of the riser is not too important. Even with a metal with high solidification shrinkage such as steel, an appreciable portion of the system has solidified and has been fed before even a discrete void is formed. The riser must furnish feed metal to compensate for shrinkage in the whole system during this period.

The riser has furnished even a greater proportion of the total feed metal in the case of dispersed shrinkage, for it is estimated that a steel section is over 90 per cent solid before dispersed shrinkage cavities form. This means that the riser has delivered over 90 per cent of the maximum feed metal it could deliver under ideal conditions. Therefore, in production the feeding range can be selected arbitrarily from experience and the riser size calculated, assuming complete feeding with a negligible error as far as the riser size is concerned.

If the casting is composed of thick and thin sections, the problem of breaking the casting down into individual risering systems is not too difficult. The thin sections will solidify rapidly enough so that each heavy section and the thinner sections attached to it will comprise an individual system.

If the casting section requiring more than one riser is uniform, the question of breaking it down into individual risering systems is more difficult, the number of risers in these cases must be determined from experience until more information is available. These risering systems are simple shapes, combinations of plates, cylinders, squares and rectangles, and an approach to determining the proper riser sizes for even the most complex casting can be made by studying the solidification characteristics of such simple shapes.

In the past every foundryman, in each type of metal, has had his own rules for proportioning the riser. In steel, the trial-and-error method of risering has been based on section thickness, depth of section, and rarely on volume or weight of the risering system. It was generally agreed, at least for steel in the United States, that the riser section should be larger than the casting section, but there was no agreement as to how much larger in section it should be. Another fairly

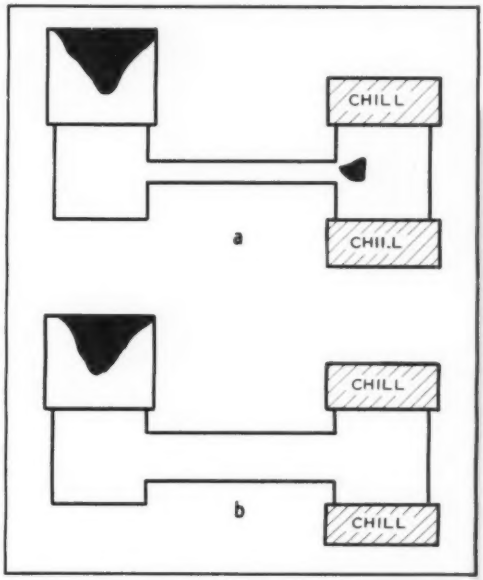



*Fig. 4—Chill applications for steel risering system.*

general rule was that the riser height should exceed the depth of section to be fed, but this rule was broken many times on deep sections. Another rule in general use was that riser height be 1½ times its section.

None of these rules, with the possible exception of the first, had any experimental foundation, nor were they observed at all times even by their strongest exponents. Other than general rules of this type, risering dimensioning in all metals was an art based solely on experience, plus a lot of plain guessing.

As the shrinkage characteristics of metals during solidification are due to a phase change they are very precise and do not vary appreciably with composition within the range encountered for any particular alloy. This should make a scientific approach to the dimensioning of risers amenable to precise mathematical study. All that need be taken into consideration is the rate of heat evolution by the metal

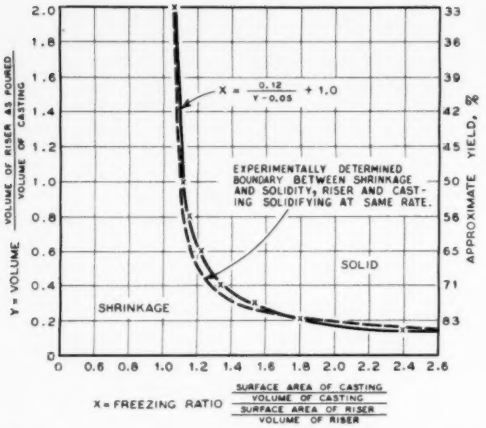



*Fig. 5—Curves showing relationship between freezing time and volume in riser systems for steel castings.*

until it has solidified and the rate of heat transfer across the sand-metal interface, as the two controlling factors in the relative rate to complete solidification of the casting and riser.

Only two factors are required for the study of this phase of risering: volume, and a factor denoting the relative rate of solidification of the casting and riser. Some limits are also known. If the solidification rate of the riser is infinitely small in relation to that of the casting the riser volume required would be equivalent to the contraction in volume during solidification plus, in some instances, the amount of liquid contraction occurring between the pouring temperature and the beginning of solidification.

In steel this would be equivalent to a riser about 5.0 per cent of the casting volume. This value is made up of 3.0 per cent solidification contraction and 2.0 per cent liquid contraction from an average pouring temperature of 2950 F, and is much smaller than that required in production. This is due to the fact that solidification in both riser and casting is progressing at the same time. For efficient scientific risering the problem is to determine the smallest riser that will solidify at a slower rate than the casting it is to feed, delivering sufficient feed metal to fill all the voids opening up within the feeding range of the riser until the casting is completely solidified.

Another limit has been established. It has been proved for steel* that a riser of a section equal to the casting section will not feed efficiently; in fact, it will not feed at all, regardless of its height, unless some type of insulation is placed around the riser to lower its freezing rate, or some addition be made to the riser to accomplish the same purpose. This limit should also apply to any metal whose solidification shrinkage is similar to that of steel. As two equal sections must solidify at the same rate, it is concluded that if the riser freezes at the same rate as the casting, the riser volume required is infinity.

Both limits are now established. If the riser freezes infinitely slowly in relation to the casting, the riser volume required is equal to the liquid contraction, plus the volume contraction on solidification. If the riser freezes at the same rate as the casting, the riser volume required is infinity. The problem now is to establish the shape of the curve designating this relation between these two extremes. The freezing times of the casting and riser between these two extremes must be in relation to the amount of heat evolved by the metal as it cools from the pouring temperature through the solidification range, and the amount of heat dissipated into the sand in contact with the casting and riser.

As a riser is a casting differing only in shape from the casting to be fed, the established relations can be used to by-pass all the difficulties associated with determining and handling absolute values such as specific heat, latent heat of fusion and, especially, the quantitative rate of heat flow across the sand-metal interface. The amount of heat evolved must be in relation to the volume; the amount of heat dissipated, to the surface area of the casting and riser.

From the standpoint of scientific riser dimensioning, the riser should be proportioned for maximum riser efficiency so that the minimum size riser freezes at a slower rate than the casting or section it is to feed. At the same time it should contain a sufficient volume of metal to satisfy the feed requirements of the casting.

It is therefore possible to neglect absolute values such as specific heat, latent heat of fusion and thermal diffusivity and solve the problems of scientific riser dimensioning with relations. Only two relations are required, one for relative volume, one for relative freezing time to complete solidification, as follows:

$$\text{(1)}\qquad \text{Volume} = \frac{\text{Riser Volume as Poured}}{\text{Casting Volume}}$$

$$\text{(2)}\qquad \left.\begin{matrix}\text{Relative Freezing}\\ \text{Time to Complete}\\ \text{Solidification}\\ \text{(Freezing Ratio)}\end{matrix}\right\} = \left\{\frac{\dfrac{\text{Casting Surface Area}}{\text{Casting Volume}}}{\dfrac{\text{Riser Surface Area}}{\text{Riser Volume}}}\right.$$

As discussed previously, Eq. (1) for volume approaches infinity as Eq. (2) for relative freezing time approaches unity. Equation (1) approaches the amount of liquid and solidification contraction when Eq. (2) approaches infinity. Such a relation indicates a hyperbolic function, most simply expressed by the equation:

$$\text{(3)}\qquad x = \frac{a}{y - b} + c$$

whose asymptotes for steel are unity relative freezing time and 0.05 relative volume. Therefore, Eq. (3) can be written for steels as:

$$\text{(4)*}\qquad x = \frac{0.12}{y - 0.05} + 1.0$$

where $y$ = volume expressed as a fraction resulting from the solution of Eq. (1), $x$ = relative freezing time in units resulting from Eq. (2). Constant $a$ has been assigned the value 0.12 empirically from experiment. Constant $b$ is the sum of the liquid and solidi-

*Constants $a$ and $b$ have been changed slightly from those first advanced by the writer in Reference 7. See the discussion appearing with this paper in A.F.S. TRANSACTIONS, vol. 56, pp. 498-501 (1948). It should be emphasized that the change is minor, either the original constants or the corrected ones, as given in this paper, can be used in production risering.

fication contractions and this value will vary according to the pouring temperature. The value 0.05 is for steel poured at an average pouring temperature of 2950 F. Constant $c$ is the measure of any change in the relative freezing rate of the casting and riser. If both casting and riser are in contact with sand and are dissipating heat into the sand at the same rate, constant $c$ is 1.0. Mathematically the inclusion of constant $c$ merely shifts one asymptote from $x = 0$ to $x = 1.0$

The solution of Eq. (4) for steel results in a curve represented by the solid line in Fig. 5. As an increase in riser size results in an increase in both the $x$ (relative freezing time) and $y$ (volume) values, those risers corresponding to points above and to the right of the curve should have sufficient volume and freeze at a rate sufficiently slow to insure solidity of the casting or section they are to feed. Those risers corresponding to points below and to the left of the line should feed improperly due either to insufficient volume or too rapid solidification.

In Fig. 5 the dotted line represents the boundary line between shrinkage and solidity determined empirically by a number of steel foundries in the United States[9] when no addition is made to the riser to reduce its freezing rate. The two curves check within the limits of experimental error. The implications of the curves shown in Fig. 5 are far-reaching. No longer need it be said that riser dimensioning is an art, for here is proof that riser dimensioning of at least steel castings follows relatively simple mathematical laws.

### Riser Insulators and Liquidizers

If insulators or liquidizers are used on or around the riser, constant $c$ will be decreased depending on the efficiency of the insulator or liquidizer. It has been determined empirically[9] that the liquidizers and pipe eliminators commonly used in this country decrease constant $c$ from 1.0 to 0.8. This change shifts the curve in Fig. 5 to the left, changing the vertical asymptote from 1.0 to 0.8. The actual value to be assigned to constant $c$ for any method of decreasing the relative freezing rate of the riser will have to be determined experimentally for that particular method.

Any method which will decrease the freezing rate of the riser in relation to the casting is quite useful in increasing riser efficiency for steel with castings of low surface area, resulting in freezing ratios below about 1.40. If the freezing ratio of the casting-riser combination is below 1.10 some method of decreasing the relative freezing rate of the riser is almost imperative (See Reference 7 for details).

It is interesting to note the approximate yields possible, with a metal with a high solidification contraction such as steel, as given to the right of the chart in Fig. 5. The values given in Fig. 5 are the yields when the weight of the gate equals that weight of metal equivalent to the volume of the shrinkage cavity in the solidified riser. In production the actual yield will vary according to the weight of the gate, being lower if a long weighty gate is used, higher if an exceptionally small or no gate be used.

As would be expected, in practice the problem is not as simple as Eq. (3) indicates, not because of any ambiguity in the equation but due to difficulty in determining the values to be assigned to $x$ in the equation. The $y$ (volume) values are simple and straightforward, simply the relative volumes of the casting and riser. All difficulties arise in the determination of the $x$ (freezing ratio) values. The surface area component in these values, the component measuring the relative rate of heat extraction, can be influenced by many independent variables.

Perhaps surface area should be called "effective surface area" for many times it is not the geometric surface area. Any part of the geometric surface area that is not in contact with a sand wall of sufficient depth to absorb all the heat generated by the metal in contact with it, until solidification is complete, cannot be included in the surface area component of the freezing ratio at its full value.

Cores contacted on more than one side by metal, reentrant angles, and changes in section, all of which restrict the flow of heat, require that the geometric surface area of the casting at these locations be included in the "effective surface area" at a fraction of its

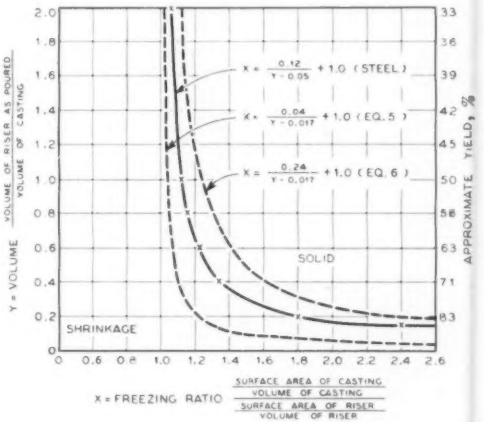



*Fig. 6—Curves showing relationship between riser freezing time and volume for metals other than steel.*

value. The correction necessary in the geometric surface area for these areas of restricted heat flow must be determined experimentally for each metal. This work should not be too difficult—much has been done for steel—and will be repaid many times, not only in increased yield but also in sounder castings.

It is interesting to speculate on the extension of the basic risering relation expressed in Eq. (3) to metals other than steel. As this is relative, the differences in specific heat, latent heat of fusion and in thermal diffusivity cancel out, and as far as this relation is concerned the only differences that need be taken into consideration for the different metals are the differences in liquid contraction, solidification contraction, and possibly the solidification characteristics.

Unfortunately, even these values are not known for metals other than steel. The volume contraction on solidification, as used in these relations, is probably different than those given in the literature. Volume

contraction on solidification, as far as riser dimensioning is concerned, may or may not be the total solidification contraction, but only that contraction in volume that opens up voids large enough to be fed by liquid metal from a riser. The 3.0 per cent contraction for steel used in this paper has been taken from the literature, and is made up almost entirely of this type of shrinkage.

Many of the non-ferrous metals, although showing a greater overall volume contraction during solidification than steel, do not open up definite voids. In foundry parlance they "freeze flat." The value for solidification and liquid contraction applicable to Eq. (3) can easily be determined for any metal in any foundry by pouring a simple shape of known volume and measuring the volume of the shrinkage cavity formed in the casting.

Even less is known as to the values to be assigned to constant $a$ for metals other than steel. Perhaps con-

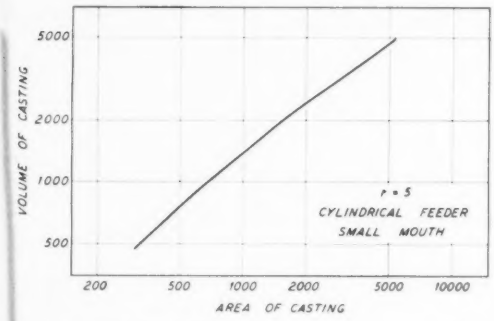



*Fig. 7—Steel casting riser determination (Schwartz[7]).*

stant $a$ is a measure of the solidification characteristics of the metal. The value for any given metal may be more or less than that for steel, and it is possible that it varies independently of constant $b$. Nevertheless, Eq. (5) and (6) are advanced as hypothetical examples, if for no other reason than to promote discussion.

$$x = \frac{0.04}{y - 0.017} + 1.0 \quad (5)$$

$$x = \frac{0.24}{y - 0.017} + 1.0 \quad (6)$$

The curves for these equations are plotted in Fig. 6 in comparison with the proved curve for steel.

Equation (5) represents a hypothetical metal with constants $a$ and $b$ one third of those for steel. Equation (6) represents a hypothetical metal with low liquid and solidification shrinkage (constant $b$ one third that of steel), but with such freezing characteristics that necessitate increasing constant $a$. As can be seen from Fig. 6, if constants $a$ and $b$ are lower than for steel (Eq. 5) the curve denoting the boundary between shrinkage and solidity lies much closer to both ordinates, and the riser sizes required are much less than those required for steel, less than one third at a freezing ratio of 1.20 and one quarter of steel values at 1.10 freezing ratio.

Such metals as the brasses and iron can possibly be risered with equations similar to Eq. (5). The line in Fig. 6 representing Eq. (6) may be applicable to such metals as the aluminum and silicon bronzes, which have low liquid and solidification shrinkage as defined in this paper, but their mode of solidification necessitates increasing constant $a$ above the value established for steel. The riser sizes for such metals would be greater than those required for steel.

Although the hypothetical curves in Fig. 6 are advanced primarily for discussion, they do have a practical application in the determination of constants $a$ and $b$ for metals other than steel. The values for constant $b$ can easily be determined for any metal.

The curves can then be used to determine constant $a$ by risering simple shapes in the region of the knee of the curve and determining the boundary line between shrinkage and solidity in this region. If the position of the knee of the curve is established, one can feel fairly assured that the position of the rest of the curve is correct. This procedure, involving a dozen or so castings, is more efficient than determining the shape as well as the position of the curve empirically, as the latter procedure involves pouring hundreds of castings.

### Solidification Shrinkage Differs

Another interesting speculation is on the relative position of the curves in Fig. 6. As will be noted the curve for steel is quite far removed from both ordinates and therefore is relatively insensitive to changes in constant $c$. The curves for metals of less solidification shrinkage fall closer to the ordinates, especially the y ordinate, and will be more sensitive to changes in constant $c$. As constant $c$ shifts the position of the curve in relation to the y (volume) ordinate, and is a measure of any difference in the relative freezing rates of the casting and riser, slight variations in constant $c$, such as those caused by temperature differentials in the mold, will be pronounced with metals of low solidification shrinkage and relatively inappreciable with metals of high solidification shrinkage.

Therefore, slight variations in mold temperature differentials, such as those caused by changes in gating, will make an appreciable difference in the feeding efficiency of a riser with a metal of low solidification shrinkage. The same change in gating practice in steel would result in an inappreciable difference in feeding efficiency. This may be a clue to the solution of a number of feeding problems in some of the non-ferrous metals and in iron.

Constant $c$ can also be used in the quantitative determination of the efficiency of any material or method used to reduce the relative solidification rate of the riser. The importance of the proper application of such materials and methods with castings of low surface area cannot be stressed too strongly, for the possible increase in yield with such castings is quite large.

Although the preceding discussion on riser dimensioning may seem purely theoretical, its application is highly practical. After the volume-freezing ratio curve has been established for any metal, the curve can be used directly in production risering. It is necessary only to calculate surface area and volume. All that need be known is the volume and surface area, making allowances for those areas of restricted heat flow.

A riser capable of feeding the casting or section can be selected from experience, and the volume-

freezing ratio of that particular casting-riser combination calculated. The point representing this combination can then be plotted on a chart similar to Fig. 6. The point should lie above and to the right of the boundary line between shrinkage and solidity for the particular metal, allowing a slight factor of safety for minor variations in pouring practice and temperature.

If the point representing the volume-freezing ratio for the first casting-riser combination does not fall in the proper location, the dimensions of the riser are increased or decreased until the proper dimensions are established. Using this "hunt and try" method, it is usual that two or three risers must be checked before the proper riser dimensions are determined.

### Riser Shapes

Schwartz[10] has developed a method that eliminates the necessity of the first arbitrary selection of a riser from experience. First, he has shown that the most efficient risers are spheres, cylinders, and combinations of spheres and cylinders, with heights not greater than twice the radius. Note that all sections are rounds, never rectangular, and that the height of the riser never exceeds the diameter. Using these risers, Schwartz has given a method of determining the proper riser dimensions for steel directly, knowing only the volume and surface area of the casting.

After a series of curves, similar to that shown in Fig. 7, have been constructed for a given metal and riser shape, the riser dimensions can be determined from a chart to accuracies of less than one inch. This can be done directly from a blue print before the pattern is made. If the riser must be dimensioned to accuracies of less than one inch, samples must be made until much more is known about what constitutes the "effective surface area" and what allowances must be made in the geometric surface area in regions of restricted heat flow.

Figure 7 is a good example of how greatly the riser size varies with the surface area of the casting. A cylindrical riser with radius of 5, from Fig. 7, and height of 10 (the values are dimensionless, either English or metric system can be used) will feed a casting with a volume of 500 if it is "chunky" with a low surface area (area = 300). The same riser will feed a casting 10 times as heavy (volume = 5000) if the surface area is increased to 5000.

Probably no other example will emphasize more strongly the need for quantitative risering control. Slight variations in one or two dimensions of the casting to be risered cause such great variation, not only in the riser dimensions but also in the number and placement of risers, that the required accuracy cannot be obtained by experience alone. Quantitative data are required. Some data have been collected in this paper, mostly for steel. More information on more metals is the most important problem of the foundry industry today, from the standpoint of quality and cost.

### Summary

An attempt has been made to approach the problem of gating and risering from the scientific point of view.

Risering has been divided into two phases, that of positioning the risers and that of dimensioning the risers so that they will efficiently feed the casting or that part or parts of the casting they are intended to feed.

A basic risering system is advanced for positioning risers. Quantitative information derived from this system for any metal can be applied to any casting, no matter how complex.

An equation is advanced for dimensioning risers:

$$x = \frac{a}{y - b} + c$$

where $x$ = freezing ratio or relative freezing time to complete solidification; $y$ = volume; constants $a$ and $b$ are in relation to the mode of solidification and the contraction from the pouring temperature through the solidification range; constant $c$ is a measure of the difference in relative freezing rate of the riser in relation to the casting, due to independent variables.

It has been established that this equation in its simplest form for steel becomes:

$$x = \frac{0.12}{y - 0.05} + 1.0$$

### References

1. S. W. Brinson and J. A. Duma, "Studies on Centerline Shrinkage in Steel Castings," A.F.S. Transactions, vol. 50, pp. 657-765 (1942).

2. W. H. Johnson and W. O. Baker, "Gating Systems for Metal Castings," A.F.S. Transactions, vol. 56, p. 389 (1948).

3. H. E. Elliott and J. G. Mezoff, "A New Gating Technique for Magnesium Alloy Castings," A.F.S. Transactions, vol. 55, pp. 242-251 (1947).

4. H. F. Taylor and E. A. Rominski, Discussion of Reference 1, A.F.S. Transactions, vol. 50, pp. 711-717 (1942).

5. H. F. Taylor and E. A. Rominski, "Atmospheric Pressure and the Steel Casting—A New Technique in Gating and Risering," A.F.S. Transactions, vol. 50, pp. 215-259 (1942).

6. E. C. Troy, "Controlled Solidification by Gradient Heat Extraction," *Steel Foundry Facts*, no. 27, 1943.

7. J. B. Caine, "A Theoretical Approach to the Problem of Dimensioning Risers," A.F.S. Transactions, vol. 56, pp. 492-501 (1948).

8. "First Report of the Foundry Practice Subcommittee," *Journal*, Iron and Steel Institute (British), vol. 151, pp. 329-391 (1945).

9. "Determination of the Factors Influencing Riser Efficiency," Steel Founders' Society of America, Research Report No. 13, 1947.

10. H. A. Schwartz, "Discussion of Reference 7," A.F.S. Transactions, vol. 56, p. 498 (1948).

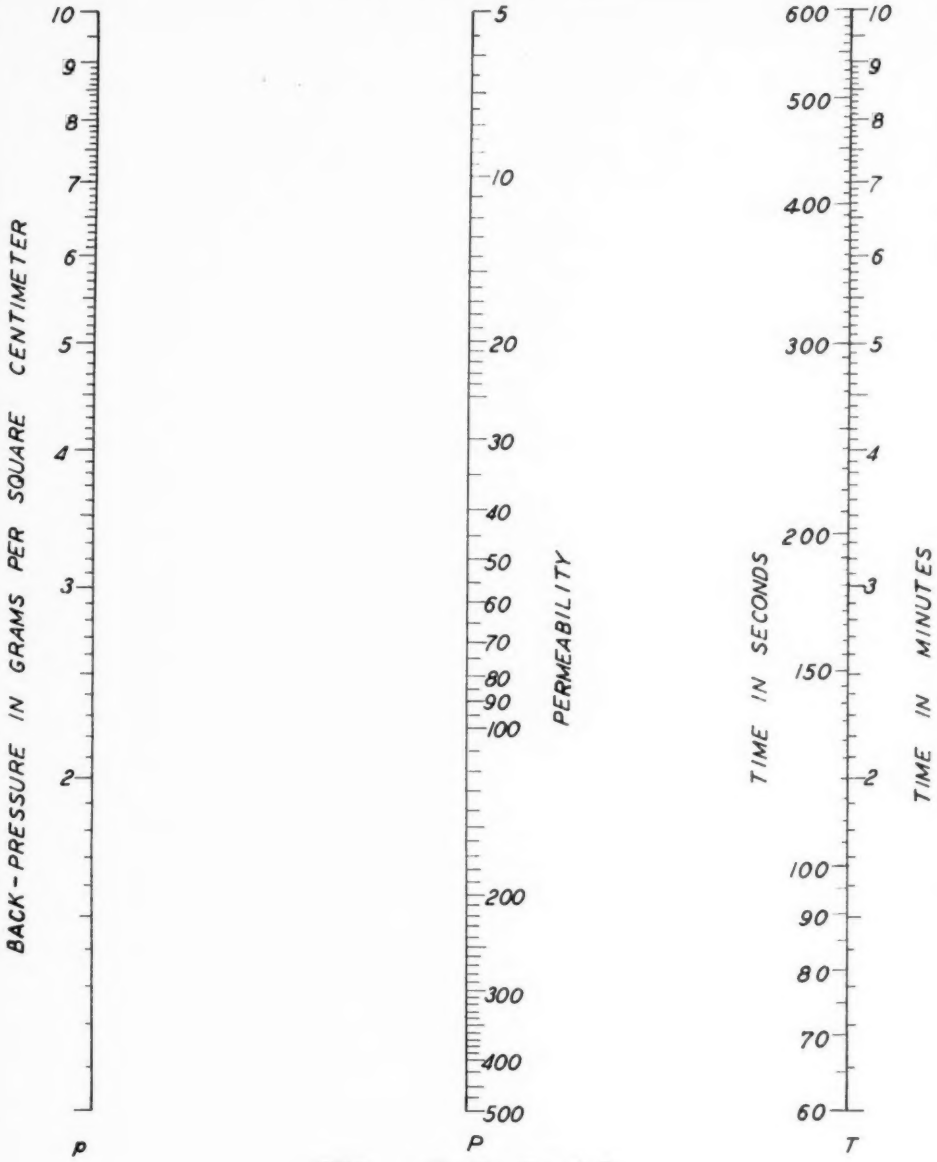
## Report On Steel Sand Properties At Elevated Temperatures Published

Available gratis to A.F.S. members is the recently-published A.F.S. *"Eighth Annual Report on the Investigation of Properties of Steel Sands at Elevated Temperatures,"* by J. P. Fraser, A.F.S. Investigator at Cornell University, and P. E. Kyle, professor of metallurgy and assistant director, School of Chemical & Metallurgical Engineering, Cornell University.

Covering work on the Sand Research Project completed during the past year under the sponsorship of the A.F.S. Sand Division, the report covers 10 pages and is divided into three parts: Part I—Hot compressive strength vs. test temperature for six sand mixtures: Part II—Hot compressive strength vs. exposure time for a 4 per cent western bentonite mixture and a 10 per cent fireclay mixture, each containing 5 per cent moisture and a N.J. No. 60 base sand: Part III—Summary and conclusions from the results reported.

Reprinted from Vol. 56, A.F.S. Transactions, this report is available to members free-of-charge by writing A.F.S. Headquarters, 222 W. Adams St., Chicago.

## NOMOGRAPH FOR DETERMINING FOUNDRY SAND PERMEABILITY




KEY: p To T; Read P

*EXAMPLE: Back-pressure (p) = 5; time in minutes (T) = 2. Lay a straightedge from (p) to (T) and read permeability (P) where the straightedge intersects the permeability scale, or P = 50*

# RAPID SAND PERMEABILITY CALCULATION

**D. S. Eppelsheimer**
**Professor of Metallurgy**
**and**
**J. E. Reynolds**
**Instructor of Metallurgy**
**Missouri School of Mines & Metallurgy**
**Rolla, Mo.**

FOR MOST ACCURATE PERMEABILITY TESTS such as those required in research, calibration, and comparison, the A.F.S. standard permeability procedure should be followed (A.F.S. FOUNDRY SAND TESTING HANDBOOK, pp. 25-26, 1944).

Observations are made on the conventional apparatus by *removing the orifice plates* before performing the standard tests. This test eliminates any errors which might result from worn gold-lined orifices.

Standard test specimens are used and the time required for two liters of air with a pressure head of 10 grams per square centimeter to pass through the specimen is recorded.

The back-pressure $(p)$ is read from the vertical pressure indicator while the air is passing through the specimen and after the pressure has become steady. The back-pressure $(p)$ is a manometer reading and should not be confused with the head pressure which is constant (10 grams per square centimeter), and $(p)$ must necessarily be within the limits 0 to 10. If two theoretical sands are considered, this point may be clarified:

**CASE I: A Sand With Zero Permeability**—This specimen would completely seal the upper end of the permeability tube. The manometer back-pressure would, therefore, be equal to the pressure head of 10 grams per square centimeter. This is why the maximum reading of the vertical scale on the permeability meter and the pressure scale of the monograph is 10 (since the back-pressure can be no greater than the head pressure).

**CASE II: A Sand With Infinite Permeability**—In this case, which is simulated by an open permeability tube, the back-pressure would be zero since the entire head pressure is used to force air upward out of the permeability tube.

Testing sands of any other permeabilities would give back-pressure readings $(p)$ between the 0 to 10 values.

◀ *Nomograph prepared for making rapid and accurate permeability determinations of foundry sands.*

Calculations may then be made according to the following formulas:

$$P = \frac{501.2}{pT}$$

where
$P$ is permeability
$p$ is back-pressure in gm/sq cm
$T$ is time in minutes for two liters of air to pass through specimen

$$P = \frac{30072}{pt}$$

where
$t$ is time in seconds

These calculations may be further simplified by using the accompanying nomograph (opposite page) prepared by the authors. Calculations are made with only a straightedge. The following example illustrates its use:

Back-pressure $(p) = 5$ gm/sq cm
Time in minutes $(T) = 2$
Manipulation of Nomograph: Lay a straightedge from $(p)$ to $(T)$, and read permeability $(P)$ where the straightedge intersects the permeability scale.

$$P = 50$$

The accuracy of this nomograph is well within the range of accuracy of most apparatus.

Other ranges may be used on these same scales of the nomograph. For instance, if the pressure readings on the scale are divided by 10, then the permeability readings must be multiplied by 10. Likewise, if the time readings on the scale are multiplied or divided by 10, then the permeability readings must be divided or multiplied by 10, respectively.

## Future Meetings and Exhibits

MALLEABLE FOUNDERS' SOCIETY, western sectional meeting, Palmer House, Chicago—Mar. 25.

ANNUAL SAFETY CONVENTION AND EXPOSITION, Hotel Pennsylvania, New York—Mar. 29-April 1.

AMERICAN GAS ASSOCIATION, distribution, motor vehicle and corrosion conference, Cincinnati—Apr. 4-6.

METAL POWDER ASSOCIATION, annual meeting, Chicago—Apr. 5-6.

AMERICAN MACHINE TOOL DISTRIBUTORS' ASSOCIATION, spring meeting, Savannah, Ga.—Apr. 11-12.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, annual conference and exhibition, Cincinnati—April 11-14.

AMERICAN SOCIETY FOR METALS, Sixth Western Metal Congress and Western Metal Exposition, Shrine Auditorium, Los Angeles—April 11-15.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, National Open Hearth Steel Committee, annual meeting, Palmer House, Chicago—April 18-20.

MAGNESIUM ASSOCIATION, Chicago—April 19-20.

MALLEABLE FOUNDERS' SOCIETY, western sectional meeting, Palmer House, Chicago—April 22.

**American Foundrymen's Society, 53rd Annual Foundry Congress, St. Louis—May 2-5.**

INSTRUMENT SOCIETY OF AMERICA, annual spring meeting, Royal York Hotel, Toronto, May 12-13.

SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS, spring meeting, Hotel Statler, Detroit—May 19-21.

MALLEABLE FOUNDERS' SOCIETY, western sectional meeting, Palmer House, Chicago—May 27.

STEEL FOUNDERS' SOCIETY OF AMERICA, industrial relations meeting, Drake Hotel, Chicago—June 9-10.

MALLEABLE FOUNDERS' SOCIETY, annual meeting, Homestead Hotel, Hot Springs, Va.—June 16-17.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Atlantic City, N. J.—June 27-July 1.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION, annual meeting, The Greenbrier, White Sulphur Springs, West Virginia—Oct. 13-15.

MICHIGAN REGIONAL FOUNDRY CONFERENCE, A.F.S. Michigan Chapters, Michigan State College, East Lansing—Nov. 15-16.

# MODERN FOUNDRY METHODS...

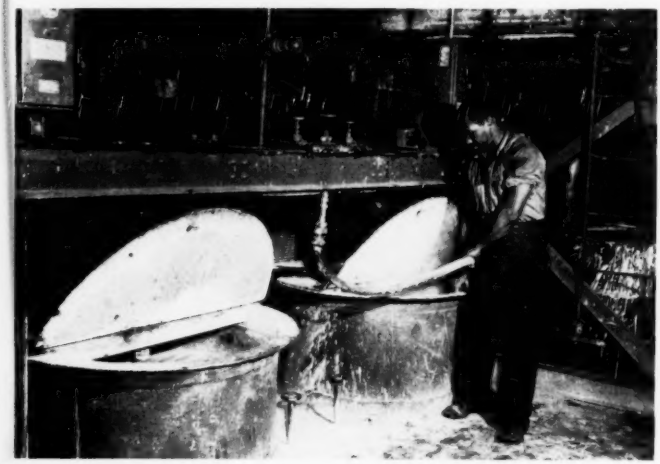
## MIXING—APPLYING MOLD AND CORE WASHES

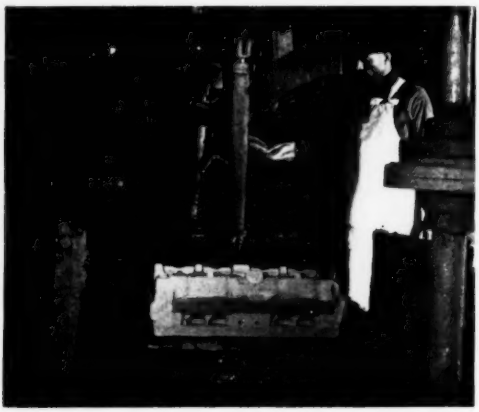
*Methods used in production foundry core wash applications shown in this month's "Modern Foundry Methods" are described in a paper by Robert B. Melmoth, metallurgical engineer, Ford Motor Co., Dearborn, Mich., presented at the A.F.S. Michigan Regional Foundry Conference held at Michigan State College, Lansing, Oct. 1, 1948.*

*Various types and sizes of mixing equipment are used in preparing core washes. A portable electric or air-operated propeller type mixer clamped on a drum or barrel can be used in any location, preferably close to the job if the wash contains materials which are difficult to keep in suspension.*

*Large cylindrical tank mixers (left, below) sunk in the floor of a third-floor balcony are easy to load from bags or wheelbarrows. The prepared core wash is distributed by gravity flow to service tanks on the floors beneath.*

*Mechanically agitated holding tanks (below) are required to insure an uninterrupted supply of wash to the foundry. The speed, position and direction of mixer paddles should be so adjusted that the wash is thoroughly mixed without entrainment of excessive air, which would cause foaming. Transfer from mixing tanks to holding tanks, and from holding tanks to dip tanks may best be done by gravity through pipes of substantial diameter. If pumps are necessary, they should be of a type which will not cause foaming. A foamy wash is difficult to apply uniformly, and is likely to blister when dried.*





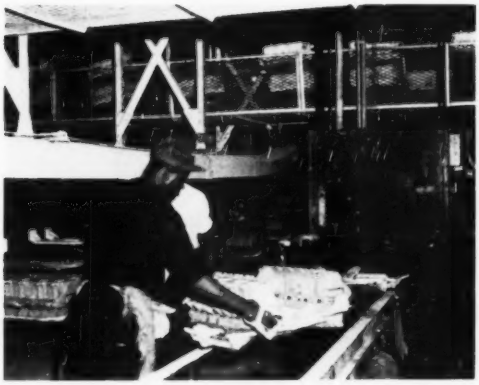
*An oscillating dip tank is synchronized with the overhead conveyor so that each hanger of cores is immersed in the wash for a specified time. The air hose used to blow off excess wash is equipped with a diffuser to reduce velocity and avoid damage to the green core. The depth of wash penetration into green sand is appreciable, and can be controlled by timing the dip and maintaining a constant Baumé. While green dipping gives an excellent bond between core and wash coating, the sealing of the core surface with a layer of saturated and impermeable material delays baking out, and this must be compensated for when calculating baking time.*

*Large cores, either green or dry, are most economically washed by spraying or swabbing. Spraying produces a good surface if the cores are dense and uniformly rammed, but is not as effective in binding loose-rammed spots as are dipping and swabbing.*

# ...MODERN FOUNDRY METHODS

◀ *This core was green dipped on a plate, and after baking must be sprayed on the plate side. The spray is applied while the cores are hot from the baking oven.*

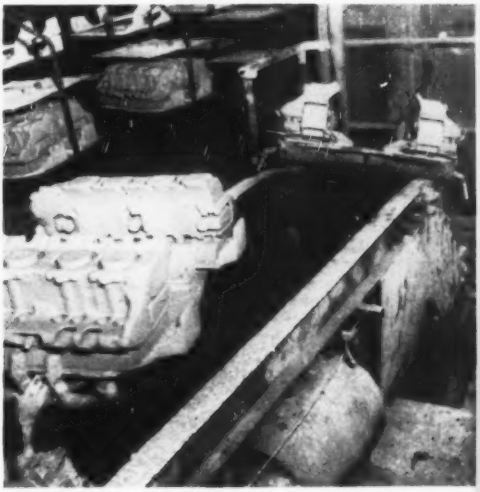
*Baked crankshaft cores are* ▶ *dipped at temperatures of about 275 F and post-heated in a gas tunnel. The wash Baumé is adjusted not only for best application but to control the overall lengths of the crankshafts. When these cores are assembled in stacks of 16, a small change in the core wash characteristics can compensate for worn core boxes, etc.*

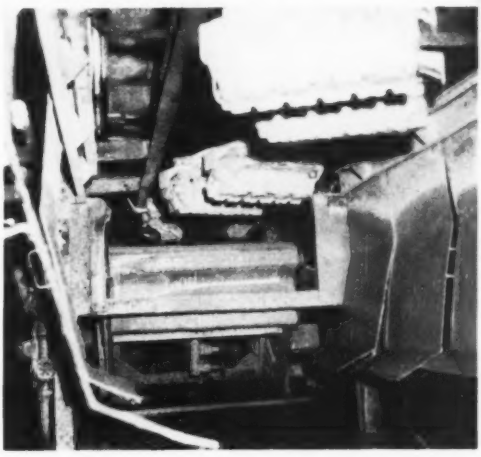


*The dip-and-spin method has proved highly successful for intricate core assemblies such as the barrel assembly shown above. The cores are taken from the paste-drying ovens and clamped to a spinning fixture on an endless chain. Exposed vents are closed with clay, plastine or rubber plugs. The clamped cores travel around the end of the conveyor (right, above) and arrive in the dip tank pit underneath in an inverted position.*

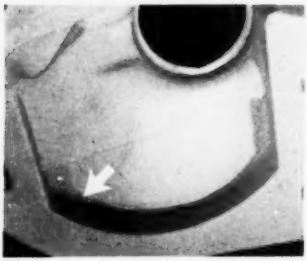
*Rise and fall of the dip tank (right) and engagement of the spinner mechanism are synchronized with the speed of the conveyor chain. As the dipped cores clear the tank they are spun between splash guards at about 100 rpm. After the excess wash has been removed by spinning the cores are returned to the ovens for drying.*

*Fairly high core strengths are necessary to withstand the acceleration of spinning, but the method is adaptable to a wide range of intricate assemblies which could not be properly washed otherwise. Spinning assures a uniform unbroken coating, minimum internal finning, and freedom from runs and teardrops. Defects caused by core washes and other methods of applying washes are shown on the following page.*





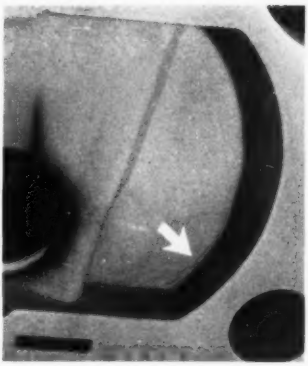
# MODERN FOUNDRY METHODS...



*Runs or teardrops (left) result from the use of an excessive amount of wash, usually of too high viscosity, and failure to adequately remove excess wash by draining or blowing. This type of defect also occurs when cores are dipped while too hot to drain smoothly.*

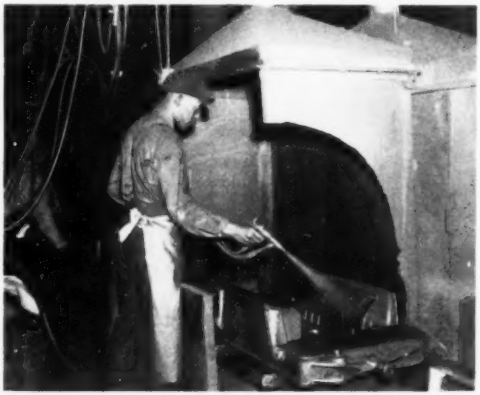
*Bubbles and blisters (left, below) may be caused by excessive core temperature, or by air entrained in the wash as a result of improper mixing or pumping. Foaming due to bacterial action in the wash may also produce this defect. Periodic cleaning of the mixers and holding tanks, in conjunction with the use of a good fungicide in the wash, will prevent the odor and foaming associated with bacterial action in the organic binders.*

*Cracking of the type shown (right, above) is often caused by an excessively heavy wash coating, which will crack during drying much more readily than would a thin coating of the same wash. If the cracking is persistent it may be necessary to reduce the clay or bentonite content, or select a wash which has a coefficient of expansion more nearly equal to that of the base sand.*



*In most cases coating defects can be remedied during core inspection. When they are accessible, runs can be rubbed smooth, and cracked or blistered areas can be stoned down, rewashed, and torch dried.*

*Short-run jobs can be spun (below), after hand dipping, on a simple set-up such as the converted centrifugal casting machine shown in the background. Dipping removes a disproportionately large amount of water from the dip tanks, which results in a gradual increase in the Baumé of the remaining wash unless measures are taken to correct the condition. Control is effected by blending in make-up wash at a lower Baumé than that desired for the actual dipping. Constant checking of the Baumé at all mixing and dip tanks, together with visual inspecton of the washed cores, will pay dividends in consistent coating results and improved casting finish.*



*A low-pressure gun (above) with a fairly large orifice is used to spray a drag mold with a compounded wash at about 28-30 Baumé. Mold washes are similar in nature and purpose to core washes, and generally are applied by spraying or swabbing. Heavy green sand molds and almost all dry sand molds are coated by these methods. Molds which are to be skin-dried usually are sprayed lightly and passed under oscillating torches, or in some cases they are hand-torched. A heavily sprayed green sand mold dried under multiple gas flames for several minutes assumes most of the properties of a dry sand mold, developing a hard crust of baked sand with sufficient strength to withstand the insertion of cores without crushing or abrading.*

# MECHANIZED FOUNDRY MAINTENANCE

**Charles T. Luther**
**Maintenance Engineer**
Central Foundry Div., G.M.C.
Saginaw Malleable Iron Plant
Saginaw, Mich.

IT IS THE PURPOSE OF THIS PAPER to describe and outline a maintenance program as set up in a mechanized foundry. The program is designed to service and keep in repair the equipment, starting with that in the melting department, through the foundry, coreroom, hard iron, annealing, cleaning, processing and shipping departments.

Figure 1 shows the general outline and relationship of the various departments. The equipment used in these departments is characteristic of the modern foundry, and includes overhead charging cranes, positive displacement cupola blowers, with hot blast and cupola humidity control. In the foundry are several sand preparation units to serve the molding machines, molding conveyors, pouring escalators and shakeout screens. Cores are baked in continuous horizontal and vertical ovens, and a large number of blowing machines are employed in the core department.

All castings are annealed in tunnel and atmosphere controlled furnaces, and are sorted after annealing on an extensive belt conveyor system. Shot blast cleaning equipment is employed, and hydraulic straightening presses are used to bring castings to actual specified shapes. Many types of conveyors, trucks and other devices are also utilized in an effort to reduce handling and lighten the work. Every possible effort is made to standardize on all equipment in order that repair parts carried in stock may be kept at a minimum.

Only a few years ago most foundries were operated with but little mechanical equipment. Floor molding was almost universal. Adequate ventilation and dust supression equipment were unheard of—long hours and hard manual labor were necessary in order to operate. Production in this type of foundry was necessarily limited and unit costs were high. The limited

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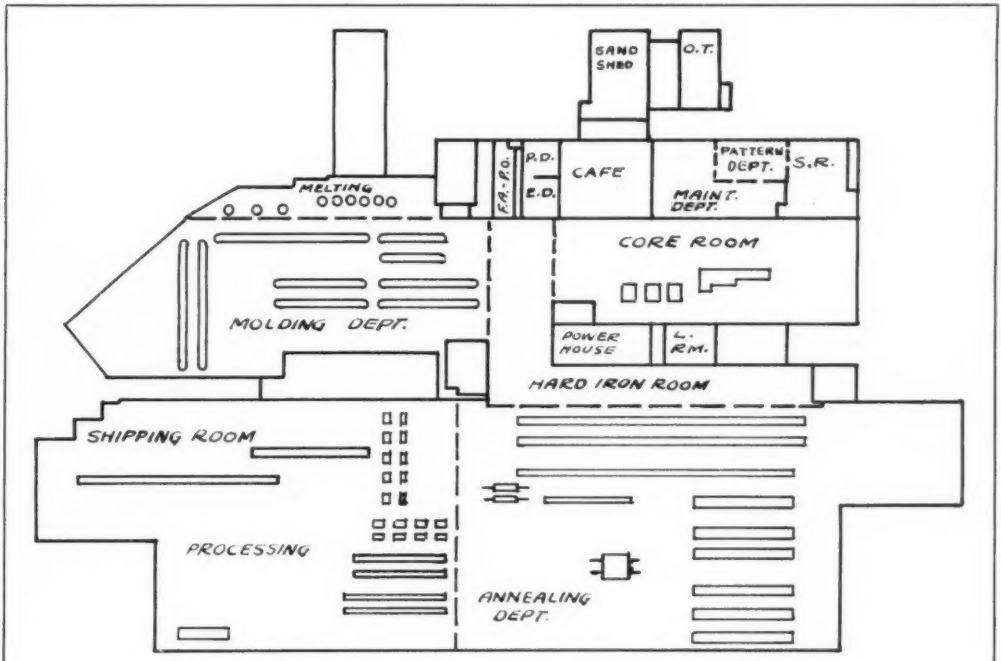



*Fig. 1—General plant layout of a mechanized foundry.*

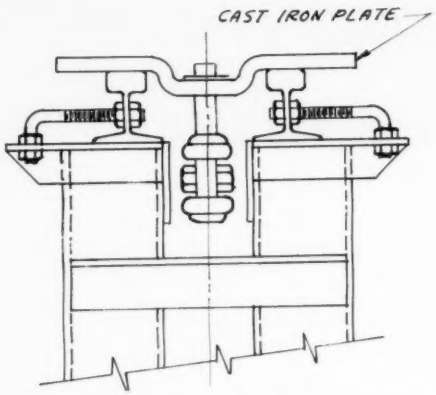



*Fig. 2—Section view of the sliding plate mold conveyor. Plates and rails are of cast iron.*

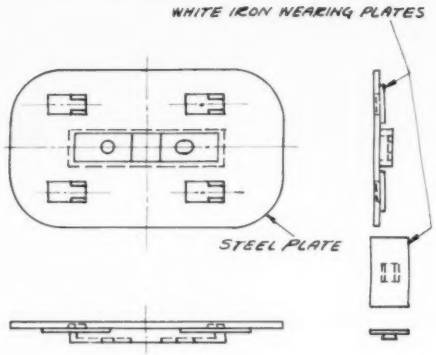



*Fig. 3—Views of new design mold conveyor plate made of mild steel with wearing shoes of white cast iron.*

amount of equipment available was generally allowed to operate until it failed completely. This would result in extended and costly shutdowns.

Installation of conveyors, continuous sand systems, and other modern machinery has greatly increased production, and has also made the foundry a better place in which to work. This change has, however, presented among other problems the necessity of maintaining the equipment in order to provide continuous operation. Expensive installations which are continually down for repairs result in loss of production and high over-all cost.

### Maintenance Section Organized

In order to properly carry out an effective maintenance program it is necessary to have an organization, the personnel of which will vary with the size of the plant, and the extent to which it is mechanized. In most cases such an organization should be set up on a three-shift basis in order that repairs may be made on the off shifts, when the equipment is idle.

In the writer's foundry, this organization consists of a maintenance superintendent and assistant, and a chief electrician. On each shift (first, second, and third) there is a general foreman who has one or more foremen under him, who are responsible for the workmen in the crafts and the care of equipment in definite areas. They are charged with the responsibility of assigning jobs to their employees, and seeing that this work is properly carried out.

The superintendent holds meetings with this organization to discuss various problems pertaining to repairs and improvements, and also to discuss company policies, so that all supervision may air their troubles and be informed as to top management's thinking. The value of these meetings cannot be overemphasized, particularly in a large organization. Problems of all sorts come up for discussion and decision, and the interchange of ideas is good whether in large or small groups.

Foundry maintenance involves two types of work—scheduled and unscheduled. The first consists of regular scheduled inspection and replacement of worn parts. The second type involves the work required in repairing breakdowns and answering service calls. The amount of unscheduled work depends to a large extent upon how well the first type of work has been performed. The cost of preventing all breakdowns undoubtedly would be prohibitive, but they can be kept at a minimum if the scheduled work is properly performed and a thorough analysis made of all troubles that have occurred and the steps taken to correct them.

Preventive maintenance should be stressed. This can be accomplished with scheduled inspections and corrective measures taken when the equipment is idle. A continuous effort must be made to improve existing equipment, which can best be accomplished by requesting and receiving suggestions from workmen as well as supervision.

In the writer's organization a detailed lubricating and oiling program is set up and a comprehensive record kept so that there will be no guesswork as to when each item requires service. Each week a card showing items which are to be lubricated, and whether daily, weekly or monthly, is provided each oiler. The individual performs the work as outlined, signs the card and returns it to the maintenance clerk. It is then posted to a master sheet and becomes a part of the plant maintenance record.

### Lubricating Equipment Standardized

All equipment in the plant has the same type of lubrication fitting in order to avoid the use of different types of guns. Standardization on a few types of good oils and greases also is of prime importance in saving time and eliminating the possibility of using the wrong lubricant. The need of training people for the proper application of these lubricants is emphasized. Care is exercised in obtaining the proper lubricant by following the equipment manufacturers' recommendations and consulting with the various oil company representatives. Actual on-the-job experience and tests in a great many instances will determine which oil or grease

should be used and how often it should be applied.

A record is also kept of all major repairs on each item of equipment. This shows at a glance the machinery continually requiring attention, the nature of the trouble, and enables the personnel of the department to concentrate on the improvement of these items. Actual costs (labor and material) of these repairs also are compiled. When new equipment is to be purchased, the maintenance people are contacted and their ideas, wherever possible, are incorporated into the design. The engineering and maintenance departments work together on all projects, and the cooperation of these two organizations is absolutely necessary in order to keep all facilities in proper repair.

It is part of the foreman's responsibility to make periodic checks with the stockroom regarding the availability of repair parts for anticipated work. Long deliveries and the scarcity of some materials occasionally make temporary or patchwork repairs necessary; however, this type of work should be avoided as breakdowns may result and much of the work duplicated.

In any maintenance program the question of the work to be performed by the plant maintenance organization and that which should be contracted for on the outside continually arises. The writer has found that, in general, better results are obtained by having trained people in the organization to make all repairs and adjustments, as well as to take care of all new work. In practice this is not always possible, and it becomes necessary to obtain service engineers from the equipment builders and also to have certain work performed by outside contractors.

### Maintenance Shop Setup

A constant effort is made, however, to acquaint our people with all the details of these repairs. This is accomplished by the use of instruction manuals, blue prints and verbal instructions and advice. It has been observed in many instances that instructions from books and directions do not give the desired information. They are generally hard to read and contain a great deal of information which is not related to the subject. Firsthand knowledge must be obtained by dismantling the equipment and actually seeing how it is constructed.

For this reason it is planned to have our plant maintenance people build and install as much equipment as possible. They will thus understand it better and take a far greater interest in keeping it in good repair.

A maintenance department, fairly centrally located with respect to the production departments, houses the general repair shops, electric shop, welding booth, pipe and carpenter shops and maintenance office. Adjacent to this setup are the stockroom and tool cribs.

These shops are equipped to make all repairs, as well as to do a considerable amount of new work. In the general maintenance setup, for instance, are lathes, milling machines, drill presses, blacksmith forge, sheet metal working machines, welding and burning equipment, and an electric truck which is used for transporting whatever is needed for making repairs on equipment throughout the plant. A repair box is stocked with tools and parts which experience has shown might be needed on repair jobs. This can be hauled wherever needed at a moment's notice. Trouble calls are received in the maintenance office and the foreman is informed of the nature of the service required.

The electric shop is equipped with the necessary tools and testers to make all electrical repairs (with the exception of rewinding motors), and also to do a great deal of new work. On new installations, motors, starters, and other electrical equipment are installed and connected as far as possible by our plant electricians. They are thus familiar with the installation and can quickly locate trouble. The electric shop houses motor generator sets, with the necessary distribution panels for charging batteries for electric trucks.

Facilities are also provided for the complete repair of electric hoists, a great many of which are used throughout the plant. All motor rewinding is performed outside the plant. Each returned motor, however, is run and tested in the shop before being installed, in order to be sure it is in proper condition. A large motor storage area is provided in order that a spare may be available for each size of motor.

*Fig. 4—Section of flame-hardened overhead conveyor trolley wheel which replaced chilled cast iron wheel.*

The carpenter, pipe and sheet metal shops, as well as the welding booth, are equipped with all necessary tools to perform the work required in their line. A truck garage is also maintained to make necessary repairs and adjustments on a fleet of trucks and tractors.

As previously mentioned, all calls requesting service are received in the maintenance office. However, because of the size of the plant, and in an effort to obtain continuous operations, each production department is assigned one or more millwrights and electricians. Their duties are to make minor repairs, inspect and lubricate equipment and answer service calls in their areas. They are charged with the responsibility of keeping the equipment in their particular zones in operation and to report to the foreman any conditions which cannot be corrected while the equipment is in operation.

The writer has found that properly designed foundry equipment generally fails because of the conditions under which it operates. Normal life cannot be expected if moving parts are operating in a pile of sand

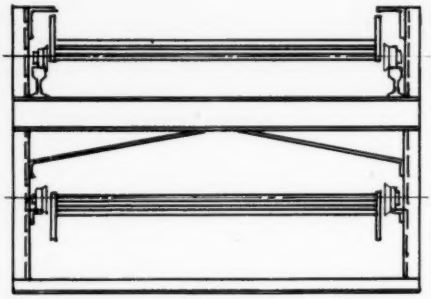


*Fig. 5—Pan conveyor section showing wheels extending beyond pan edges. This type of construction exposed wheel bearings to dust and dirt from the conveyor pan.*

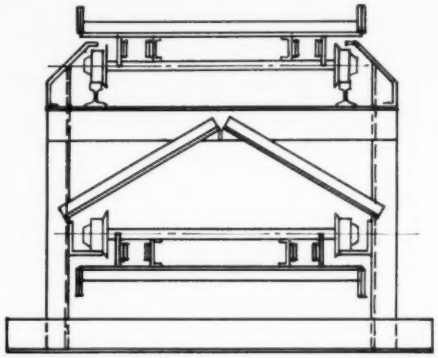


*Fig. 6—Redesigned pan conveyor section with wheels underneath the pans, thus protecting the wheel bearings.*

or under dusty conditions. These adverse conditions should be studied and eliminated with necessary guards and for adequate ventilation.

Most equipment breakdowns are due primarily to bearing failure. Bearings wear out in most cases not because of overloads or lack of lubrication, but because of dirt. Generally too little care is given to keeping oil and grease clean. The importance of proper covers on containers should be stressed, and the practice of filling guns with paddles discontinued because of the partial filling usually received and the contamination encountered. The use of suitable transfer and grease gun loader pumps should be encouraged. The writer believes that more use should be made of sealed bearings, which are packed with grease at the factory for lifetime lubrication. These bearings have a wide application for head shafts, idlers, wheels, etc.

Considerable use can also be made of stainless steels for suction piping, fan housings, hoods, guards and other sheet metal parts which, because of condensation and other adverse conditions, are subject to excessive corrosion. Black and galvanized iron, in a great many instances, are found to be completely oxidized in a comparatively short time. Nickel-chrome alloys, while considerably more expensive, easily pay for themselves in a relatively short period.

The use of heat treated and hardened gearing, sprockets, trunnions, and other parts subject to excessive wear has proved advantageous over the customary gray cast iron or mild steels. The small increase in original cost is more than offset by the greater life obtained.

Installation of totally enclosed ball-bearing motors has proved good economy and is undoubtedly more or

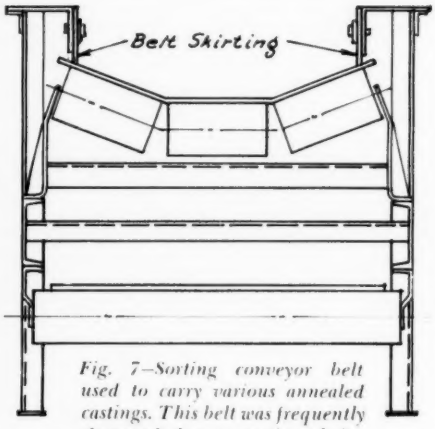



*Fig. 7—Sorting conveyor belt used to carry various annealed castings. This belt was frequently damaged due to castings being caught along the belt skirting.*

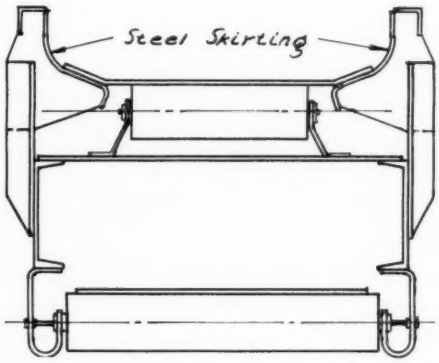



*Fig. 8—Section of sorting conveyor showing the redesigned belt skirting which greatly reduced belt damage.*

less standard throughout the foundry industry. Special motors should be avoided wherever possible, and all motors of the same size should be purchased in the same frame number so that they will be interchangeable, thus reducing the number of spares needed.

As mentioned in a previous paragraph, efforts are continually being made to improve existing equipment. A few of the changes which have been adopted from suggestions received are of interest.

Figure 2 shows a section of a sliding plate mold conveyor, consisting of a standard keystone chain to which are fastened a series of plates which slide on two parallel rails. Both plates and rails are subject to considerable wear and require frequent replacements. The original plates were of cast iron, but mild steel with white cast iron wearing shoes was substituted (Fig. 3). This change has resulted in longer rail life and the plates last indefinitely, it being necessary to replace the wearing shoes about once a year.

Considerable trouble had been experienced with flat spots developing on trolley wheels on overhead conveyors. Figure 4 illustrates in section a flame-hardened wheel which was cast, machined and hardened in our plant, and has proved to outlast several times the original chilled cast iron wheels. It has also materially increased the life of the double-angle track on which it runs, and has reduced the horsepower required to operate the conveyor.

Pan conveyors, with bearing equipped wheels, are used for breaking gates and sorting castings as they come from the shakeouts. Figure 5 shows such a conveyor, with the wheels outside the pan edges, resulting in dust and dirt getting into the bearings. Attempts to guard the wheels proved unsatisfactory. Figure 6 illustrates the same type conveyor so constructed that the wheels are under the pans, which form a perfect guard and increase bearing life.

Sorting belt conveyors, which carry miscellaneous annealed castings, are subject to ripping and tearing of the belt due to castings being caught along the skirting. Figure 7 shows a cross section of such a belt with the conventional type of skirting. By substituting skirting, as shown in Fig. 8, this belt damage can be greatly reduced. The metal pan as shown actually forms a trough for the belt to operate in, and has proved very successful, in spite of a slight increase in horsepower required to operate the conveyor.

### Conclusion

Many more phases of maintenance procedure could be discussed. It should be realized that the maintenance program in different foundries will vary, depending upon their size and the amount of equipment being used.

However, summarizing the foregoing observations, it would appear that a well-organized maintenance program should include the following:

(1) Regular scheduled inspection and repair
(2) A definite lubricating procedure
(3) Detailed records of performance and costs
(4) Encouragement of suggestions for improvement of existing equipment.

## FEF Is Host To Hamilton, Ohio, High School Students

*These 48 students and faculty members from three Hamilton, Ohio, high schools were part of a group of 200 southwestern Ohio students invited to a Foundry Educational Foundation meeting for high school faculty, students and foundrymen at the University of Cincinnati, January 18. Prominent Ohio foundrymen and educators spoke to the students on foundry training at the meeting, which was followed by a tour of the University's laboratories.*

# WHO'S WHO

C. T. Luther

Charles T. Luther, author of *"Mechanized Foundry Maintenance"*, Page 61, is maintenance superintendent for the Saginaw Malleable Iron Foundry, Central Foundry Division, General Motors Corp., Saginaw, Mich. . . . A graduate of the Michigan College of Mining and Technology, in 1924, Mr. Luther was later employed by Consolidated Coal Co. . . . He joined Saginaw Malleable Iron in 1928 as a draftsman, was appointed maintenance superintendent in 1938 . . .

J. B. Caine

J. B. Caine, whose article, *"Risering Castings,"* appears on Page 46, has authored many articles for the technical press and has been a frequent speaker before A.F.S. meetings . . . He is a member of the Executive Committee of the A.F.S. Sand Division . . . Mr. Caine attended both the University of Cincinnati and the Case Institute of Technology prior to serving a two-year apprenticeship at Interstate Foundries, Cleveland, in 1924-25 . . . After completing his apprenticeship, he joined Matthews Steel Castings Co., Cleveland, as metallurgist, and in 1932 left that position to become metallurgist with the Sawbrook Steel Castings Co., Lockland, Ohio.

M. H. Young

Melvin H. Young, co-author with A. G. Slachta of *"Magnesium Castings Designed for Aircraft Engines"*, Page 41, is chief of the Materials Laboratory of Wright Aeronautical Corp., Wood Ridge, N. J. . . . Holder of a B.S. in Metallurgy from Yale University, Mr Young has been with Wright since 1933, first as an assistant metallurgist (1933-36), then project engineer (1936-40), and since 1940 has been in charge of Wright's Materials Laboratory . . . Mr. Young's co-author, **Andrew G. Slachta,** is supervisor of Foundry & Heat Treating Metallurgy at Wright Aeronautical's Materials Laboratory . . . Mr. Slachta first entered the Materials Laboratory at Wood Ridge in 1942 as a junior metallurgist.

R. B. Melmoth

Robert B. Melmoth, author of *"Modern Foundry Methods—Core Wash Applications"*, Page 58, like his famous father, A.F.S. Seaman Gold Medalist Frederick A. Melmoth, was born in Sheffield, England . . . Attended high school in Detroit and graduated in 1941 with a degree in Chemical Engineering from Lawrence Institute of Technology after having served successively as chemist and metallurgist with the Detroit Steel Casting Co. . . . In 1946, joined Ford Motor Co, Dearborn, Mich., as metallurgical engineer.

J. E. Reynolds

James E. Reynolds, co-author with Dr. Eppelsheimer of *"Rapid Sand Permeability Calculation"*, Page 56, is Instructor in Metallurgy at the Missouri School of Mines . . . A graduate of the University of Alabama in 1941 with a B.S. in Metallurgy, Mr. Reynolds joined Reichhold Chemicals, Inc., Tuscaloosa, Ala., as a chemist that same year, prior to joining the Navy as an electronic technician . . . Later, he entered the Missouri School of Mines, receiving his M.S. in Metallurgical Engineering in 1948, and joined that institution in his present capacity as instructor that same year.

D. S. Eppelsheimer

D. S. Eppelsheimer, co-author with J. E. Reynolds of *"Rapid Sand Permeability Calculation"*, Page 56, has had an extensive back ground in both education and industry . . . Dr. Eppelsheimer graduated B.S. Cum Laude in Engineering from Harvard University in 1932 and received his D. Sc. there in 1935 . . . Later joined Union Carbide & Carbon Corp. as research metallurgist . . . In 1938, he was appointed to a research associate professorship at the University of New Hampshire and headed that school's Experimental Station . . . In 1946, he became sales manager for Metal Hydrides, Inc., Beverly, Mass., leaving a year later to become associate professor of Metallurgy at the Missouri School of Mines.

## A. F. S. Employment Service

To contact firms seeking personnel through "Help Wanted" items write to American Foundrymen's Society, 222 West Adams St., Chicago 6, designating Item Number and issue of AMERICAN FOUNDRYMAN in which published. A.F.S. Applicant Registration Form then will be sent to applicant for filling in and returning to A.F.S.

Firms desiring to contact applicants should write A.F.S., designating Item Number and issue. Copy of applicant's Registration Form then will be sent to firms.

### POSITIONS WANTED

**PW105—Metallurgist:** Age 32, married, family, B. S. in metallurgy from Case Institute of Technology. Nine years diversified experience in ferrous foundries specializing in sand, melting and heat treating. Qualified for research, supervisory, management and sales. Best references. Strong advocate of good human relations; active in service organizations and community affairs.

**PW106—Planning Engineer:** Foundry engineer available soon. About 14 years in foundry engineering, job evaluation, production control, plant layout. Served foundry apprenticeship; have been general foreman iron jobbing foundry, chief industrial engineer and management engineer. Thorough practical gray iron experience, some malleable experience. Studied at Illinois Institute of Technology; taught time and motion study there.

**PW107—Metallurgist:** Non-ferrous and ferrous metallurgist with long experience in research, laboratory control, management, and as technical advisor. Extensive experience in preparation of engineering reports, author of several hundred metallurgical papers and two books; translator of many French and German publications.

**PW108—Foundry Engineer or Production Superintendent:** Over 30 years experience in up-to-date mechanized jobbing and production foundries making iron and steel castings for wide range of products. Recently completed work on most modern, largest automotive foundry built since war. If you want to mechanize, can save you money.

# New A.F.S. MEMBERS

**Period January 15-February 15: New A.F.S. members for the first period of 1949 number 139, including eight company members. The new Mo-Kan Chapter, 40th chapter in A.F.S., led with 29 members. Other leading chapters were: Chicago, 16; Quad City, 12; and Eastern Canada & Newfoundland, 9.**

## NEW COMPANY MEMBERS

**Joman Steel Co., Davenport, Iowa**—Joe C. Alter, Partner (Quad City Chapter).

**Newbury Mfg. Co., Inc., Talladega, Ala.**—R. A. Donaldson, V. P. & Gen. Mgr.—Conversion from Personal (Birmingham Chapter).

**Crown Non-Ferrous Foundry, Chester, Pa.**—Claude H. Fryburg, Pres. (Philadelphia Chapter).

**American Smelting & Refining Co., Federated Metals Div., Milwaukee, Wis.**—John L. Kammermeyer, Dist. Mgr. (Wisconsin Chapter).

**The Sandy Hill Iron & Brass Works, Hudson Falls, N. Y.**—Cleon King, Fdy. Supt. (Eastern New York Chapter).

**The Gurney Foundry Co., Ltd., Toronto, Ont., Canada**—L. B. Morris, Works Mgr. (Ontario Chapter).

**Societe Anonime Acieres De Haine, St. Pierre, Belgium**—Nicholas Rappez, Admin. Dir.—Conversion from Personal.

**Independence Stove Furnace Co., Independence, Mo.**—J. S. Weeks (Mo-Kan Chapter).

## BRITISH COLUMBIA CHAPTER

J. C. F. MacLeod, Dist. Engr., Canadian Liquid Air Co., Vancouver, B. C., Canada.

## CANTON DISTRICT CHAPTER

David E. Gilman, Wks. Mgr., Ashland Malleable Iron Co., Ashland, Ohio.
Kenyon D. Love, Vice-Pres. & Asst. Sec. Treas., The Colonial Foundry Co., Louisville, Ohio.
Carl Ludwig, Bonnot Co., Canton, Ohio.

## CENTRAL INDIANA CHAPTER

Ben Paller, Pres., Paller Engineering Co., Indianapolis, Ind.

## CENTRAL NEW YORK CHAPTER

William W. Dalgety, Fmn. of Brass Fdy., Oberdorfer Foundries, Inc., Syracuse, N. Y.

## CENTRAL OHIO CHAPTER

Stanley Bradley, Molder, Lattimer Stevens, Columbus, Ohio.

## CHESAPEAKE CHAPTER

Lawrence W. Jakeman, Molder, Norfolk Naval Shipyard, Portsmouth, Virginia.

## CHICAGO CHAPTER

Edward G. Bowdish, Fdy. Supt., Illinois Malleable Iron Co., Chicago.
Robert Anthony Cech, Student, Northwestern University, Evanston, Ill.
Walter A. Czapla, Chief Chemist, Pettibone-Mulliken Corp., Elmwood Park, Ill.
Clarence Greasley, Castings Met., Electro-Motive Div. G.M.C., La Grange, Ill.
Henry Johnson, Fmn., Western Foundry Co., Chicago.
Charles J. Knuska, Fmn., Link Belt Co., Chicago.
Charles E. Ludwig, Div. Mgr., Spencer Turbine Co., Chicago.
John Marcec, Riverside Iron Works, Chicago.
Robert W. Meloy, Gen. Fmn. (Clean. Rm.), Link Belt Co., Chicago.
Robert F. Miller, Frank Miller & Sons, Chicago.
Walter A. Mucek, Asst. Met., Howard Foundry, Chicago.
William Notenberg, Steel Clean. Fmn., Link Belt Co., Chicago.
Edward R. Novotny, Insp. Fmn., Link Belt Co., Chicago.
William A. Prendergast, Appr., Continental Foundry & Machine Co., E. Chicago, Ind.
Walter J. Ramsy, Jr., Abr. Engr., Waltham Grinding Wheel Co., Chicago.
Charles H. Sidman, Abr. Engr., Waltham Grinding Wheel Co., Chicago.

## CINCINNATI CHAPTER

Walter N. Greule, Metallurgist, Lunkenheimer Co., Cincinnati.

## DETROIT CHAPTER

Joseph C. Metyko, Metal Patternmaker, Packard M. C. Co., Detroit.
R. B. Richardson, Dist. Sls. Agt., Spencer Turbine Co., Detroit.
Raymond H. Sutter, Pres., Sutter Products Co., Dearborn, Mich.

## EASTERN CANADA & NEWFOUNDLAND CHAPTER

Ernest Bissonnette, Asst. Wks. Mgr., Joliette Steel Ltd., Joliette, Que., Canada.
W. L. Campbell, Asst. Wks. Mgr., Joliette Steel Ltd., Joliette, Que., Canada.
La Salle Gaston, Chemist, Joliette Steel Ltd., Joliette, Que., Canada.
Jean Paul Joly, Pattn. Shop Supv., Joliette Steel Ltd., Joliette, Que., Canada.
T. F. Kennedy, Supt., Enamel & Heating Products Ltd., Amherst, Nova Scotia, Canada.
Andre Levesque, C/R Supv., Joliette Steel Ltd., Joliette, Que., Canada.
Fernand Plouffe, Fdy. Supv., Joliette Steel Ltd., Joliette, Que., Canada.
Lucien Preville, Clean. Supv., Joliette Steel Ltd., Joliette, Que., Canada.
James Wilcock, Chemist, Dominion Engineering Works, Lachine, Que., Canada.

## EASTERN NEW YORK CHAPTER

Ralph J. Denton, Owner, R. J. Denton Co., Syracuse, N. Y.
Herbert C. Gibbs, Salesman, Penn. Fdy. Supply & Sand Co., Philadelphia.
The Sandy Hill Iron & Brass Works, Hudson Falls, N. Y. (Cleon King, Fdy. Supt.).

## METROPOLITAN CHAPTER

Robert H. Beetle, Asst. Met., Met. Dept., American Brake Shoe Co., Mahwah, N. J.
Stephen J. Dale, Labor Fmn., Worthington Pump & Machine Corp., Harrison, N. J.
John Fecko, Gen. Fmn., Worthington Pump & Machine Corp., Harrison, N. J.
Edward Kubaska, Fmn. of Sand Control, Worthington Pump & Machine Corp., Harrison, N. J.
Edward B. Newton, Tech. Repr., Carbide & Carbon Chemicals Corp., New York.
Victor Paschkis, Tech. Dir., Columbia University, New York.
Alexander V. Sabunas, Asst. Fmn., Singer Sewing Mach. Co., Elizabeth, N. J.

## MO-KAN CHAPTER

Wm. Arbeiter, Owner, Master Craft Pattern & Model Works, Kansas City, Mo.
E. L. Austin, Jr., V. P. & G. M., National Aluminum & Brass Fdy. Inc., Independence, Mo.
Herbert V. Barron, C/R Fmn., Neville Foundry Co., Inc., N. Kansas City, Mo.
G. Donald Clay, Appr., Clay & Bailey Mfg. Co., Kansas City, Mo.
Thos. D. Crick, Independence Stove & Furnace Co., Independence, Mo.
Frank Dean, Jr., Supt., Alabama Pipe Co., N. Kansas City, Mo.
Milton B. Gold, Partner, Gold Foundry & Mach. Works, Independence, Mo.
Truman W. Hiatt, Fdy. Fmn., National Aluminum & Brass Fdy. Inc., Independence, Mo.
Howard Julian, Blue Valley Foundry, Kansas City, Mo.
Alan G. Linley, Chem. Engr., Locomotive Finished Material Co., Atchison, Kansas.
Douglas E. Loveland, Fmn., Brass Smelter, Sonken-Galamba Corp., Kansas City, Kansas.
Millard McCann, Fdy. Fmn., Gold Fdy. & Machine Works, Independence, Mo.
James H. McCord, Res. Mgr., Alabama Pipe Co., N. Kansas City, Mo.
L. B. Morrell, Sales Repr., E. F. Houghton & Co.
John D. Muse, Prod. Engr., Neville Foundry Co., Inc., N. Kansas City, Mo.
W. Leslie Neville, Pres., Neville Foundry Co., Inc., N. Kansas City, Mo.

Sol Samazin, Salesman, Sonken-Galamba Corp., Kansas City, Kansas.
E. Donald Schmidler, Supt., Gold Foundry & Machine Works, Independence, Mo.
H. P. Schwickrath, Price Brass Mfg. Co., Kansas City, Mo.
Tom Shadwick, Fdy. Supt., Witte Engine Works Div., Oil Well Supply Co., Kansas City, Mo.
Lawrence W. Shoemake, Fdy. Fmn., T & W Manufacturing Co., Kansas City, Mo.
E. C. Sooy, Secy. Treas., The Kansas City Hay Press Co., Kansas City Mo.
N. H. Sooy, Sr., Pres., The Kansas City Hay Press Co., Kansas City, Mo.
Leo Stinpfel, Mgr., Kansas City Pattern Works, Kansas City, Mo.
Herman Strauch, Blue Valley Foundry, Kansas City, Mo.
Herbert E. Tawney, Pres., T & W Manufacturing Co., Kansas City, Mo.
J. L. Weeks, Independence Stove & Furnace Co., Independence, Mo.
J. S. Weeks, Independence Stove & Furnace Co., Independence, Mo.
Louis A. Weir, Fdy. Fmn., Neville Fdy. Co., Inc., Independence, Mo.

## NORTHEASTERN OHIO CHAPTER

Fred W. Hendra, Pattn. Shop Fmn., Cleveland Foundry Div., Grand Industries, Cleveland.
Walter F. Zippler, Melting Fmn., Cleveland Foundry Div., Grand Industries, Cleveland.

## NORTHWESTERN PENNSYLVANIA CHAPTER

Dominic Crolli, Clerk, Bucyrus-Erie Co., Erie, Pa.
Edward A. Loria, Fellow, Mellon Institute, University of Pittsburgh, Pittsburgh.
George B. Mong, Modern Pattern Works, Erie, Pa.
Martin C. Robinson, Gen. Fdy. Fmn., Jarecki Mfg. Co., Erie, Pa.
Charles F. Williams, Supt., Meadville Foundry Co., Meadville, Pa.

## ONTARIO CHAPTER

Ronald C. Timms, Asst. Mgr., Welland Iron & Brass Ltd., Welland, Ont., Canada.

## PHILADELPHIA CHAPTER

John A. Baker, Sls. Engr., Sterling Wheel Div., Cleveland Quarries Co.
C. L. French, Jr., Maint. Engr., Bethlehem Steel Co., Bethlehem, Pa.
Claude H. Fryburg, Pres., Crown Non-Ferrous Foundry, Chester, Pa.
W. F. McKee, Consultant, Dodge Steel Co., Philadelphia, Pa.
Lester Y. Radcliffe, Closing Frm., Bethlehem Steel Co., Bethlehem, Pa.

## QUAD CITY CHAPTER

Joman Steel Co., Davenport, Iowa (Joe C. Alter, Partner).
G. J. Bagley, Plt. Mgr., J. I. Case Co., Bettendorf, Iowa.
William M. Chown, Industrial Relations Supv., J. I. Case Co., Bettendorf, Iowa.
Earl S. Farber, Supt. of Maint. Fdy., J. I. Case Co., Bettendorf, Iowa.
Charles H. Hoerter, Fdy. Student, International Harvester Co., Moline, Ill.
Leo E. Jackson, Prod. Control (Fdy.), J. I. Case Co., Bettendorf, Iowa.
Floyd S. Johnson, Fdry. Supt., John Deere Des Moines Works, Des Moines, Iowa.
Raymond McKinney, Fmn. Melt. Dept., J. I. Case Co., Bettendorf, Iowa.
John S. McNally, Asst. to Plt. Mgr., J. I. Case Co., Bettendorf, Iowa.
Martin C. Sievertsen, Gen. Fmn., Clng. Room, J. I. Case Co., Bettendorf, Iowa.
Francis P. Snyder, Pattn. Engr., J. I. Case Co., Bettendorf, Iowa.
Joseph A. Zeglen, Fmn. Mold., J. I. Case Co., Bettendorf, Iowa.

## SOUTHERN CALIFORNIA CHAPTER

Jeffery W. Meyer, Slsmn., Wilson & Geo. Meyer & Co., Los Angeles.
John E. Parks, Asst. Supt., Apex Steel Corp., Los Angeles.
John Walton Taylor, 2564 Centinela Ave., Los Angeles.

## TENNESSEE CHAPTER

Reece C. Hartman, Gen. Labor Fmn., Combustion Engrg. Co., Inc., Chattanooga, Tenn.

## TEXAS CHAPTER

Herbert A. Turner, Sr., Lufkin Foundry & Machine Co., Lufkin, Texas.

## TRI STATE CHAPTER

Woody W. Miller, Slsmn., Moorelane Co., Tulsa, Okla.

## TWIN CITY CHAPTER

C. T. Brudzinski, Owner, N. W. Brass & Aluminum Foundry, St. Paul, Minn.
Perry D. Goldberg, Met., Pufahl Foundry Inc., Minneapolis, Minn.
Arthur P. Olson, Asst. Fmn. Mold. Dept., Minneapolis Elec. Steel Castings Co., Minneapolis, Minn.
John Staver, II, Student, Staver Foundry Co., S. Virginia, Minn.
John J. Uppgren, Instr., Fdy., University of Minnesota, Minneapolis, Minn.

## WASHINGTON CHAPTER

E. S. Malkin, Slsmn., National Carbon Co., Seattle, Wash.

## WESTERN MICHIGAN CHAPTER

H. J. Mackay, Owner & Gen. Mgr., Mackay Industrial Sales Co., Grand Rapids, Mich.
Milford Alan Morse, Mang. Appr., Campbell, Wyant & Cannon Fdy. Co., Muskegon, Mich.

## WESTERN NEW YORK CHAPTER

George Fyderek, Worthington Pump & Machinery Corp., Buffalo, N. Y.
Walter J. Zaremba, Fmn., American Radiator & Sanitary Corp., Buffalo.

## WISCONSIN CHAPTER

Herbert F. Runkel, Vice Pres., Lake Shore Sandy Stone Co., Milwaukee.
American Smelting & Refining Co., Federated Metals Div., (John L. Kammermeyer, Dist. Mgr.).

## STUDENT CHAPTERS

### MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Edward B. Berninger
Stanley F. Callis
Lloyd B. Marshall
Louis G. Peloubet

### MISSOURI SCHOOL OF MINES & METALLURGY

Charles R. Hymes
William J. Ruprecht
Edward Skalka

### OREGON STATE COLLEGE

Glenn R. Kach

## OUTSIDE OF CHAPTER

### Argentina

Ing. Benedicto Trevis, Thyssen–Lametal, Stabilimento Crefin, Buenos Aires, Argentina.

### Australia

Harold A. Stephens, Res. Officer, Council for Scientific & Industrial Research, Melbourne C. 1., Victoria, Australia.

### Austria

Vereinigte Asterr Eisenund, Stahlwerke A. G. Zeitschriftenstelle, Linz A. D. Donau, Austria.

### Belgium

Jean Scouvemont, Mgr., Fonderies B. Lebrun, Nimy lez Mons, Belgium.

### England

B. X. Plastics, Ltd., Library–Brantham Wks., Essex, England.
Noel D. Ridsdale, Mgr., Ridsdale & Co., Middlesbrough, Yorkshire, England.

### Finland

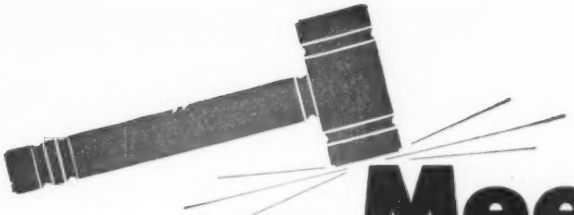
Paavo Asanti, Doctor Engr., State Institute for Technical Research, Lonnrotink, Helsinki, Finland.

# FEF Requests Data On Summer And Permanent Foundry Job Openings

REQUESTS FOR STUDENT EMPLOYMENT for both summer foundry jobs and permanent positions for graduate foundry engineering students have been sent to member foundries throughout the country by the Foundry Educational Foundation.

Company data sheets, to be filled in with information on the number of students required, types of work available, college preferences and other pertinent data are being sent to all member companies of the Foundry Educational Foundation. At a later date, member foundries will be supplied with a list of students available for either summer or permanent employment.

While it is expected that most students will place themselves by interviews with company representatives or by direct correspondence with the companies themselves, this move on the part of the FEF is expected to help those students who have not placed themselves by May 1.



# Chapter Meetings

### MARCH 15

**ROCHESTER**
Seneca Hotel, Rochester, N. Y.
W. B. McFERRIN
Electro Metallurgical Co.
*"Gray Iron Castings Defects"*

**EASTERN NEW YORK**
Circle Inn, Lathams Corners
CLYDE A. SANDERS
American Colloid Co.
*"Molding Practice and Casting Defects"*

### MARCH 17

**OREGON**
Heathman Hotel, Portland
W. B. ZIEGELMUELLER
Electric Steel Castings Co.
*"Labor-Aiding Devices for the Small Foundry"*

**DETROIT**
Rackham Memorial Bldg.
THOMAS BUTLER
Ford Motor Co.
*"Preventive Maintenance in the Foundry"*
LESTER B. KNIGHT
Lester B. Knight & Associates, Inc.
*"Economics of Foundry Modernization"*

### MARCH 18

**WASHINGTON**
Gowman Hotel, Seattle
ALEXANDER FINLAYSON
Pacific Car & Foundry Co.
*"Manufacturing Cast Crank Shafts for Diesel Engines"*

### MARCH 21

**QUAD CITY**
Ft. Armstrong Hotel, Rock Island, Ill.
FRED G. SEFING
International Nickel Co.
*"Casting Soundness as Affected by Gating, Risering and Porosity"*

### MARCH 22

**CENTRAL MICHIGAN**
American Legion Club, Battle Creek
JAMES H. SMITH
Central Foundry Division, GMC
*"The Need for Foundry Educational Programs"*

### MARCH 25

**ONTARIO**
Royal Connaught Hotel, Hamilton
GROUP MEETINGS

### MARCH 25

**CHESAPEAKE**
Engineers' Club, Baltimore
R. A. FLINN
American Brake Shoe Co.
*"Heat Treatment of Gray Iron"*

### MARCH 28

**NORTHWESTERN PENNSYLVANIA**
Moose Club, Erie
RALPH L. LEE
General Motors Corp.
*"Production Rhythm"*

### APRIL 4

**CHICAGO**
Chicago Bar Association
ROUND TABLE MEETINGS

**CENTRAL INDIANA**
Athenaeum, Indianapolis
E. M. STRICK
Erie Malleable Iron Co.
*"Malleable Iron Finishing"*

**METROPOLITAN**
Essex House, Newark, N. J.
GEORGE H. BRADSHAW
Philadelphia Naval Shipyard
*"Foundry Practice on Copper-Base Alloys"*

### APRIL 6

**TOLEDO**
Toledo Yacht Club, Toledo, Ohio
J. L. KIMBERLEY
American Smelting & Refining Co.
*"Continuous Casting of Rods and Tubes"*

### APRIL 7

**CANTON DISTRICT**
V.F.W. Headquarters, Canton, Ohio
CHARLES LOCKE
Armour Research Foundation
*"Modern Trends in Heading and Gating"*

**TWIN CITY**
Covered Wagon, Minneapolis
VINCENT J. SEBLON
Master Pattern Co.
*"Pattern Making"*

### APRIL 8

**EASTERN CANADA & NEWFOUNDLAND**
Mount Royal Hotel, Montreal
PRESENTATION OF PRIZE WINNING ENTRIES IN CHAPTER TECHNICAL PAPERS CONTEST

### APRIL 8

**CENTRAL NEW YORK**
Cornell University, Ithaca
HARRY W. DIETERT
Harry W. Dietert Co.
*"The Relationship Between Casting Defects and Physical Properties of Foundry Sands"*

**PHILADELPHIA**
Engineers' Club, Philadelphia
G. B. COMFORT
Schramm, Inc.
*"Compressed Air and Air Compressors"*
A. L. GARDNER
Pangborn Corp.
*"Cleaning Devices and Dust Collectors"*
R. SHIRE
Tabor Mfg. Co.
*"Molding Machines"*

### APRIL 11

**CENTRAL OHIO**
Bancroft Hotel, Springfield, Ohio
CLYDE A. SANDERS
*"Molding Practice and Casting Defects"*

**CINCINNATI DISTRICT**
Wayne Hotel, Hamilton, Ohio
FRANK G. STEINEBACH
Penton Publishing Co.
*"Foundry Progress"*

### APRIL 12

**ROCHESTER**
Seneca Hotel, Rochester, N. Y.
C. O. BARTLETT
Bartlett & Snow Co.
*"Plant and Plant Equipment"*

**N. ILLINOIS - S. WISCONSIN**
Freeport, Ill.
BRADLEY H. BOOTH
Carpenter Brothers, Inc.
*"Foundry Sands—Their Production and Use"*

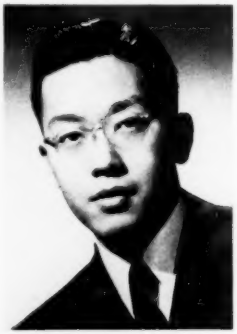
### APRIL 14

**NORTHEASTERN OHIO**
Cleveland Club, Cleveland
FRANK C. RIECKS
Ford Motor Co.
Motion Picture: *"Foundry Operations at Ford"*

# FOUNDRY Personalities

**Edward E. Hook,** 1946-47 chairman of the Central New York Chapter of A.F.S., has been appointed Eastern sales manager for the Dayton Oil Co., Dayton, Ohio, and will make his headquarters at 263 Grant Blvd., Syracuse, N. Y. Prior to joining Dayton Oil in 1943, Mr. Hook spent 31 years in the foundry industry with the American Radiator Co., Buffalo, N. Y., and Pierce Buttler Radiator Corp., Syracuse. He is at present a director of the Central New York Chapter.

**Hsin-Chong Shih,** A.F.S. member from China who recently completed an intensive engineering training course in United States foundries and foundry equipment



H. C. Shih

plants, has been appointed manager of Foreign Industrial Relations of the Hsin Hwa Engineering Co., Shanghai. A graduate of Shanghai's Ta-Tung University in 1946 with a B.S. in Electrical Engineering and Metallurgy, Mr. Shih became a student engineer in this country, successively, with the Pittsburgh Lectromelt Corp., Pittsburgh, Pa.; Lindberg Engineering Co., Chicago; Wheelco Instrument Co., Chicago; Western Foundry Co., Chicago; and the Badger Malleable & Mfg. Co., South Milwaukee, Wis.

**Paul C. Schwarz,** for seven years general foreman of the St. Louis plant of the National Bearing Division of the American Brake Shoe Co., recently joined the Binkley Mfg. Co., Warrenton, Mo., as assistant foundry superintendent and sales engineer. Mr. Schwarz is reporter for the St. Louis District Chapter of A.F.S.

**Robert E. Christian,** assistant metallurgist at the research laboratories of the American Brake Shoe Co., Mahwah, N. J., is now taking a business administration course at the Harvard Business School, Boston, and plans to return to the foundry field sometime next year.

**H. B. Voorhees,** foundry superintendent of the Peru Foundry, Peru, Ind., joined the sales staff of the United Oil Manufacturing Co., Erie, Pa., as Indiana representative as of February 7. Mr. Voorhees will make his headquarters in Mishawaka, Ind., in the future.

**Fernand Frenay** and **Joseph F. Goffart,** director and chief engineer, respectively of John Cockerill Co., Seraing, Belgium, were recent visitors to A.F.S. Headquarters in Chicago. Mr. Goffart is vice-president of the Association Technique de Fonderie de Belgique.

**Roy E. Jones,** assistant export manager for the Link-Belt Co., Chicago, has been appointed export manager, succeeding **Carl A. Woerwag,** who recently retired because of ill health. Mr. Jones, who holds an M.E. from the University of Pennsylvania, joined Link-Belt in 1927, and for seven years was engaged in engineering and design work prior to joining the company sales department in 1935. He has worked in export sales since 1941.

**Bernard A. Annis,** formerly foundry engineer with Lester B. Knight & Associates, Inc., Chicago, has joined the Hydro-Blast Corp., Chicago, in that capacity and will work with the sales department.

**James W. Wolfe, Jr.,** formerly student foreman with the International Harvester Co., recently joined the Lawran Foundry Co., Milwaukee, as superintendent. Mr. Wolfe attended Northwestern University and Denison University, and served as a First Lieutenant of Anti-Aircraft in World War II, prior to joining Ace Foundry Co. of Chicago as a student foundry engineer under a two-year training program organized by the Non-Ferrous Founders Society. Upon completion of his training program, Mr. Wolfe joined International Harvester as student foreman. He is the son of James W. Wolfe, Sr., executive secretary of the Non-Ferrous Founders Society, Chicago.

**H. L. Smith,** formerly field metallurgist with the Federated Metals Division of the American Smelting & Refining Co., has been appointed to the newly-created position of Executive Technical Engineer of the Division, it is announced by A. M. Callis, General Sales Manager. Mr. Smith has been field metallurgist for the last 10 years, working with customers on development and production problems. In his new position he will be assisted by a staff of service engineers and foundry technicians, who will aid him in broadening the services of the company to the non-ferrous metalworking industry. Mr. Smith began as a chemist in the company's Pittsburgh plant 25 years ago, and has since held many positions there. He has lectured before many technical organizations and has written for the technical press. Mr. Smith is a member of the A.F.S. Brass and Bronze Division's Round Table Subcommittee and of AIME, ASTM, and ASM. He will continue to make his headquarters at 615 Gross St., Pittsburgh.

**H. L. Campbell,** author of the well-known college textbooks, *Metal Castings* and *The Working, Heat Treating and Welding of Steel*, recently joined the staff of the Precision Scientific Co., Chicago, as an expert on foundry sand and core testing equipment. Mr. Campbell holds a B.S. in Chemical Engineer-

H. L. Campbell

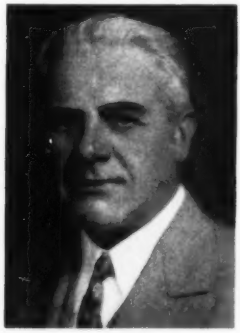
ing and an M.S. in Engineering from the University of Michigan, where from 1921 to 1936 he supervised foundry and forge shop courses. Since 1936 Mr. Campbell has been employed as a metallurgical engineer with the American Hoist and Derrick Co., St. Paul, Minn., and with the Western Foundry Co., Chicago. A member of several A.F.S., ASM and ASTM committees, Mr. Campbell has been a frequent speaker at A.F.S. meetings on core practice.

**J. G. Pearce,** director of the British Cast Iron Research Association, was recently awarded an honorary doctor's degree from Technical University, Aix-la-Chapelle. Mr. Pearce has attended many A.F.S. Conventions as representative of the British Cast Iron Research Association.

**Otto A. Pfaff,** president of American Wheelabrator & Equipment Corp., Mishawaka, Ind., was recently elected a member of the Board of Directors of the Signode Steel Strapping Co., Chicago, manufacturers of steel strapping and strapping equipment. Mr. Pfaff also holds directorates in the Electromode Corp., the St. Joseph Bank & Trust Co., South Bend, Ind., and

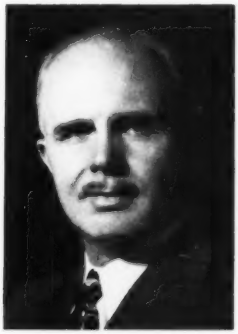
the National Castings Council. He is a past president of the Foundry Equipment Manufacturers Association, a trustee of the Foundry Educational Foundation, and a Past National Director of A.F.S.

**American Steel Foundries,** Chicago, announces that Thomas Drever, formerly company president, was elected chairman of the Board of Directors at the Board's annual meeting in New York, January 27. Succeeding Mr. Drever as president is **C. C. Jarchow,** former company vice-president. Other major executive changes announced were the appointment of C. E.



**Thomas Drever**

Grigsby, assistant vice-president, to be vice president, and L. T. Moate, assistant to the controller, to be assistant controller. Mr. Drever was born in Scotland, where



**C. C. Jarchow**

he became a chartered accountant prior to moving to New York and later Boston, where he was an accountant until 1910. He joined American Steel Foundries as controller in 1910 and was, successively, secretary and treasurer, director, vice-president and treasurer, president, and now, chairman of the Board. He is also chairman of the Board of Griffin Wheel Co., Chicago. Mr. Jarchow, who succeeds Mr. Drever to the presidency of American Steel Foundries, holds a Certified Public Accountant's degree in Illinois and has been with American Steel Foundries since 1912. He was appointed controller in

*(Continued on Page 87)*

# A. F. S. CHAPTER DIRECTORY

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**7**

# CHAPTER ACTIVITIES NEWS

### Metropolitan Chapter

George Baer
Atlas Foundry Company
Publicity Chairman

THE CHAPTER held its monthly meeting Monday evening, January 3, at the Essex House, Newark, N. J. After dinner, Chairman John A. Bukowski turned the meeting over to Thomas J. Wood, American Brake Shoe Co., Mahwah, N. J., vice-chairman of the chapter, who introduced leaders for round table discussions of "*Foundry Defects and Control.*"

A. E. Keskulla, Star Aluminum Co., New Market, N. J., led the discussion of the defects in the light metal foundry, which hinged mainly on the problems encountered in the permanent mold aluminum foundry and the various means of overcoming them.

The principal theme of the gray iron discussion group, headed by John Van Haver, Worthington Pump & Machinery Co., Harrison, N. J., was the problem of continuously increasing mechanization and dividing of responsibility in the foundry due to the breaking down of operations and the resultant closer control required by top supervision in order to locate the source of casting defects and thereby reduce them to a minimum.

The malleable iron group, led by L. R. Spann, Eastern Malleable Iron Co., Naugatuck, Conn., discussed the use of oil and plastic core binders and their effect on quality, as well as melting practices and the problems involved in the storage of sand and coal.

Bernard M. Ames of the New York Naval Shipyards, Brooklyn, N. Y., led the discussion of the copper base alloys group. This group covered a wide range of subjects based on the difficulties encountered in the brass and bronze foundry and various means of overcoming and controlling them.

Numerous X-Ray films were displayed by D. W. Talbot, Cooper Alloy Foundry Co., Hillside, N. J., showing defects caused by gas, shrinkage and sand inclusions, encountered in the manufacture of alloy steel castings. He explained the problems and the steps that were taken to eliminate them, such as heading, gating, sand mixtures, etc. Herbert Cooper of Cooper Alloy Foundry Co., spoke briefly on the progress being made in the introduction of oxygen to reduce the carbon content in melting stainless steels.

### Birmingham District

J. P. McClendon
Stockham Valves & Fittings
Chapter Reporter

A MOST INTERESTING PROGRAM at the January meeting featured Ralph Hassett, pattern shop supervisor, Texas Foundries, Inc., Lufkin, Texas, who discussed "Core Blowing, and Venting and Rigging of Core Boxes".

Mr. Hassett gave a very interesting talk and his discussion of the questions at the forum period proved he is a practical and technical pattern maker and an expert on tool, die, jig and fixture work. Under his supervision the Core Department of Texas Foundries, Inc., has become one of the most highly mechanized in the South. Because of his wide experience he is fre-

*Installation ceremonies of the Oregon State College Student Chapter of A.F.S., held December 7. Left: Student Chapter Chairman John Oettinger (left) receives gavel from J. Otis Grant, Electric Steel Foundry Co., Portland, Chairman of the Oregon Chapter. OSC President Strand and Student Member David Crabtree are seated at table. Right: Chairman Oettinger, Dean Gleason of the OSC School of Engineering, Dr. Strand, A.F.S. National President W. B. Wallis and Prof. H. R. Dahlberg, foundry instructor and faculty advisor to the OSC Student Chapter. Story in February issue of American Foundryman, page 27.*

*Prominent Indiana foundrymen and guest speakers at the February 7 meeting of the Central Indiana Chapter were, left to right: Carl Schopp, Link Belt Co., Indianapolis; Alfred A. Hilbron, A.F.S. Convention and Exhibits Manager, Chicago; J. A. Bowers, American Cast Iron Pipe Co., Birmingham, Ala.; Wm. M. Ball, R. Lavin & Sons, Inc., Chicago; Chairman Robert Langsenkamp, Langsenkamp-Wheeler Brass Works.*

quently consulted on complex core blowing problems.

Seventy-three foundrymen and friends attended the dinner preceding the technical meeting. Dr. J. T. MacKenzie, Chapter Chairman, introduced Dan Dimick, Sr., now retired, who told of his experience as a pioneer foundryman in Birmingham. Mr. Dimick, who now lives in Boston, recalled many interesting events in the early life of Birmingham. His son, Dan Jr., now owns and operates the Dimick Casting Company in Birmingham. Dan Jr., has just completed a term as a member of the Board of Directors of the Birmingham District chapter.

### Central Indiana

W. K. Mitchell
L. W. & W. K. Mitchell Co.
Chapter Reporter

NATIONAL OFFICERS' NIGHT, held Monday, February 7, at the Athenaeum, Indianapolis, featured a brief resume of plans for the 1949 national convention presented by Alfred Hilbron, A.F.S. Convention and Exhibits Manager.

Speakers for the meeting, which was divided into ferrous and nonferrous sections, were William M. Ball, metallurgical and foundry consultant for R. Lavin & Sons, Chicago, non-ferrous speaker; and J. A. Bowers, metallurgical superintendent, American Cast Iron Pipe Co., Birmingham, Ala., ferrous speaker.

At a chapter director's meeting preceding the dinner and chapter meeting, Allen J. Reid, district sales manager of General Refractories Co., Indianapolis, was appointed to head committee which will assist the A.F.S. plan for sale of publications by chapters.

### Rochester

G. Etherington
Gleason Works
Chapter Reporter

THE JANUARY 11 MEETING, held at the Palm Room of the Hotel Seneca, Rochester, featured an address by B. P. Mulcahy, Indianapolis foundry consultant on *"Foundry Coke and Cupola Operation."*

In cupola operation the comparison of air rate to coke rate is of extreme importance. The speaker pointed out that air is one component over which the operator may have complete control. The balance of the rates of carbon monoxide and carbon dioxide formation determine what is going on inside the cupola. The only function of the tuyeres is to distribute the air evenly around the periphery of the cupola, said Mr. Mulcahy.

The speaker discussed coke properties and claimed that the physical properties, in particular size and strength, were of equal or greater importance than the chemical properties. As the size of the coke decreases, the surface area for a given amount of coke increases.

The charge density is important in effecting cupola operation. The more dense the charge, the more of the blast goes up the side walls, Mr. Mulcahy said.

The physical dimensions of the cupola set the operating limits. The bosh and refractories are not as important as operating procedure. Air rate must be selected for the melting rate and coke ratio.

Regarding cupola coke, Mr. Mulcahy stated that careful handling is of prime importance. Small sized

*Foundrymen watching a core blower demonstration at Tri-State Chapter's January meeting. (Photo courtesy F. E. Fogg, Acme Fdry. & Machine Co.)*

*Intent listeners at the January meeting of the Birmingham District Chapter were, left to right, Dan Dimick, Sr., retired foundryman; his son, Dan, Jr., owner of Dimick Casting Co., and J. T. Gilbert, Stockham Valves and Fittings, Inc.*

coke should be screened out. The coke should be weighed and booster charges used only for correction.

Mr. Mulcahy illustrated his talk with a series of interesting slides. The talk was followed by a lively discussion period.

### Central Illinois Chapter

V. W. Swango
Caterpillar Tractor Co.
Secretary-Treasurer

THE FIRST MEETING of 1949 was held January 3 at the Jefferson Hotel, Peoria, Ill. C. A. Sanders, American Colloid Co., Chicago, presented a talk on *"Foundry Sands"*, in which he made many comparisons between natural and synthetic bonded sands, giving the benefits and problems of each and mentioning that there would be less synthetic sand in use today if more attention had been given to conservation of natural sands.

With the foundry industry fast returning to a competitive basis, Mr. Sanders said, more attention is being focused on costs, and the cost of excessive scrap is due to the lack of proper sand control.

Too many foundries, he said, depend too much on the sand supplier to furnish them with the proper sand, instead of setting up controls to get the best sand for their use.

The ideal sand as it comes from the supplier, according to the speaker, is not one that has an equal percentage of three or four different grain sizes, but one that has a high percentage of any particular grain size and tapers off equally about three sieves in each direction. Mr. Sanders concluded his talk by stating that numerous casting defects could be eliminated by the closer control of sand.

### Eastern New York Chapter

John M. Jones
American Locomotive Company
Publicity Chairman

THE FIRST MEETING of the year was held at Circle Inn, Lathams Corners, New York, January 18. L. P. Robinson, director of core oil sales—for the Werner G. Smith Co., gave a talk before the chapter on *"Variables in the Coreroom"*.

Mr. Robinson spoke on the future of the foundry business, then brought out the advantages of proper control in the coreroom. In closing his talk, Mr. Robinson stressed the value of proper inspection of finished cores.

### Twin City

O. J. Myers
Werner G. Smith Co.
Chapter Reporter

THE JANUARY AND FEBRUARY MEETINGS, both held at the Covered Wagon, Minneapolis, featured addresses, respectively, on *"Foundry Sand Practices"*, by Charles B. Schureman, National Lead Co., and *"Control of Casting Defects"*, by W. B. McFerrin, Electro Metallurgical Co., Detroit.

More than a hundred foundrymen attended the January 4 meeting to hear Mr. Schureman who stated that the objectives of a sand consultant are: (1) To render a foundry sand conscious, and (2) To determine current practices and the results therefrom.

In his estimation, in so far as molding sand is concerned, the major factors which determine its good or bad points are (1) Choice of base sand, (2) Choice of bonding clay, (3) Mixing.

As for testing molding sand, the speaker said, moisture is the most important determination—followed by sand screen distribution.

Speaking on *"Control of Casting Defects"*, at the February 3 meeting, W. B. McFerrin illustrated his talk with lantern slides. Mr. McFerrin is a member of the committee that wrote the American Foundrymen's Society publication, ANALYSIS OF CASTINGS DEFECTS.

According to Mr. McFerrin, the degree to which foundries solve their control of casting defects is a direct indication of their success in the foundry business.

Mr. McFerrin set forth the procedure for the analysis of casting defects in the foundry and stated that management is too prone to blame the worker for casting defects caused by other factors.

The speaker showed how pouring metal can potentially cause 24 foundry defects, while metal composition causes only 13.

Mr. McFerrin exhibited an excellent series of slides depicting defective castings and explained the

*Pufahl Foundry's photographer snapped this group of Twin City foundrymen getting ready to leave for home at the close of the January meeting.*

*In a relaxed mood at the January meeting of the Wisconsin Chapter were, left to right, E. T. Wilander, Hercules Powder Co., Chicago; Theodore Mikalosewski of Maynard Electric Steel Casting Co., Milwaukee; and H. F. Headley and E. W. Warner, both of Grede Foundries, Inc., Milwaukee. (Photograph courtesy of Walter V. Napp, Badger Fire Brick & Supply Co.)*

reasons for the defects. Among the photographs shown were those wherein: (1) The geometric shape of the riser influenced the feeding of the castings. (2) The height of feed controlled the height of shrinkage in both the riser and the casting. (3) Aggravated disseminated blows were caused by non-ferrous materials in ferrous scrap. (4) The effect of 1½ ounces of aluminum per ton on the control of temper carbon nodules was shown.

### Tri-State

**F. E. Fogg**
**Acme Foundry & Machine Co.**
**Chapter Reporter**

"CORE BLOWERS", as discussed by Otto Ostermann, Redford Iron & Machine Co., Detroit, was the principal address at the January 21 meeting, held in the Captains' Dining Room of the Douglas Aircraft works at Tulsa, Okla., January 21 and attended by 80 members.

With the aid of a blower and various boxes, Mr. Ostermann presented factors determining best blower operation. Flow of sand, number of vents, blow-holes, type of sand, and the all-important moisture content, are among the principal factors involved, he said.

The speaker stressed that 90 per cent of core box wear is due to improper rigging, and also that instantaneous filling is important, and cited specific cases of proper rigging actually increasing the life of boxes. Mr. Ostermann stated, "The success of any blower or rigging depends upon some form of standardization". During the discussion that followed, the speaker answered many questions and offered many helpful suggestions.

### St. Louis District

**Paul C. Schwarz**
**Binkley Mfg. Co.**
**Publicity Chairman**

A "HOT" DISCUSSION during and following his talk on "*'Cook Book' Gating and Risering*" caused the speaker, Harry H. Kessler of the Sorbo-Mat Process Engineers, to take off his coat and make liberal use of blackboard sketches and tables at the January 13 meeting, held at the York Hotel, St. Louis.

The controversy on gating and risering that is prevalent among foundrymen was intensified by Mr. Kessler's statements that his company has reduced the problem to fairly simple "cook book" formulae for most castings weighing over 100 lb. The capacity crowd attending the meeting gave proof of widespread interest in Mr. Kessler's ideas on the subject.

One of the highlights of the meeting took place when members of the A.F.S. Student Chapter of the Missouri School of Mines and Metallurgy were introduced to the chapter. Almost the entire student chapter made the 120-mile trip for the meeting. The students were accompanied by Dean Curtis Wilson, Professors David Walsh and D. S. Eppelsheimer, and Metallurgy Instructor James E. Reynolds of the School of Mines.

### Saginaw Valley

**K. H. Priestley**
**Vassar Electroloy Products, Inc.**
**Chapter Reporter**

"INDEPENDENT Foundry and Pattern Shop Night" was the designation of the February 3 meeting, held at Fisher's Hotel, Frankenmuth, Mich., and attended by 225 members and their guests.

Men from independent foundries in the area were presented to the membership by H. H. Wilder, Eaton Mfg. Co., Foundry Division, Vassar; while the independent patternmakers were presented by J. E. Winston, City Pattern and Engineering Co., Flint.

The speaker of the evening was Edgar Maier, plant superintendent, Saginaw Pattern & Mfg. Co., Saginaw, who spoke on "Modern Pattern Equipment". The speaker stated that the patternmaker must be equipped with foresight, good judgment and analytical ability—combining the skills of the metallurgist, coremaker, rigger, gating ex-

*Seated at the speakers' table at the February 3 meeting of the Saginaw Valley Chapter, were, left to right, J. E. Winston, City Pattern & Engineering Co., Flint, Mich.; Edgar Maier, speaker of the evening, Saginaw Pattern & Mfg. Co., Saginaw; E. C. Hoenicke, Eaton Mfg. Co., Foundry Division, Vassar, Mich.; and E. F. Booth, Saginaw Pattern & Mfg. Co.*

*Photographed at the January 24 meeting of the Northwestern Pennsylvania Chapter were, left to right, Chapter Chairman Joseph S. Hornstein, Meadville Malleable Iron Co.; Speaker N. Ransohoff, N. Ransohoff, Inc., Cincinnati, Ohio; and Vice-Chairman J. A. Shuffstall, National Erie Corp.*

*Crying the blues were these two entertainers at Eastern New York Chapter's Annual Christmas Party. (Photo courtesy L. M. Townley, Adirondack Foundries and Steel Co.)*

pert and cleaning room supervisor.

Materials for patterns, the speaker said, must be selected with a view to the number of castings to be made, tolerances to be maintained and ultimate use.

Technical chairman for the meeting was J. E. Winston, City Pattern & Engineering Co., Flint.

### Washington

Fred R. Young
E. A. Wilcox Co.
Chapter Secretary

TWO SPEAKERS were featured at the January meeting of the chapter, held January 21 at the Gowman Hotel, Seattle. Alfred W. Gregg, Whiting Corp., Harvey, Ill., spoke on the mechanization of small foundries, and his cousin, A.F.S. National Director Robert Gregg, Reliance Regulator Corp., Alhambra, Calif., reported on conditions in foundries in Europe, which he visited last year. Members of the local chapter of the American Society for Metals were guests of the chapter.

### Central New York

John A. Feola
Crouse-Hinds Co.
Chapter Reporter

FEBRUARY'S DINNER MEETING featured an address on *"Foundry Refractories"* by R. J. Denton, Eastern representative of the A.P. Green Fire Brick Co. The meeting, held February 11 at the Onondaga Hotel, Syracuse, was presided over by Chapter Chairman G. M. Fletcher, The Fairbanks Co., Binghamton, and was attended by some 75 members and guests.

Preceding his talk, Mr. Denton presented a motion picture, produced by his company and showing methods of processing and manufacturing foundry refractories. The film covered the manufacture of refractory products from the preparation of clays and bonds, down through the loading of the finished product.

During his talk, the speaker selected types of refractory failures and offered suggestions as to elimination of these troubles. Mr. Denton also stressed the necessity for selecting the correct refractory material for every application.

Mr. Denton concluded by pointing out that the fusion point of a refractory material is often not as important a factor in the selection of a refractory as is its "workable range".

During the social hour following the technical session, two movies were shown—"Fishing" and "Gridiron Parade of 1948."

### Northeastern Ohio

Robert H. Herrmann
Penton Publishing Co.
Publicity Chairman

ROUND TABLE AND PANEL DISCUSSIONS, held simultaneously on such subjects as foundry equipment, casting finishing, inspection and patternmaking, were featured at the January 13 meeting of the chapter, held at the Tudor Arms Hotel, Cleveland.

At the foundry equipment session Earl Turner, in the unavoidable absence of Arthur J. Tuscany, executive secretary, Foundry Equipment Manufacturers' Association, spoke on the subject *"What's New in Foundry Equipment."* He discussed sand preparation equipment, wet and dry cleaning mills, a new type annealing furnance, and the difference between mechanized foundries and older types.

Earl M. Strick, finishing superintendent, Erie Malleable Iron Co.,

*(Continued on Page 88)*

*A.F.S. National Director W. J. MacNeill, Dayton Malleable Iron Co., was a featured speaker at the January meeting of the Central Indiana Chapter as part of the A.F.S. Chapter Visitation Program.*

# *Quantity*
# PRODUCTION
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## GREY IRON CASTINGS

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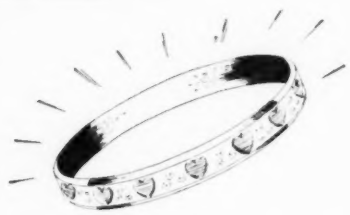
# CHIEF KEOKUK'S

# Heap Big Wedding

Here is the groom—Ready and willing



Here is the RING—(Isn't it thrilling?)

Here's the medic—With painted hide

In fact, here's everything—Except the BRIDE!

*And where is the blushing bride? She's busy getting her war paint on too! And stitching that last bit of lace on her buckskin. Who is Keokuk's mystery bride? Is she a lulu or a droopy heiress? Will Keokuk marry for love or money?* For the answers watch for the next breathless episode In The Life and Loves of Chief Keokuk.

*60-lb. pigs for steel plants*

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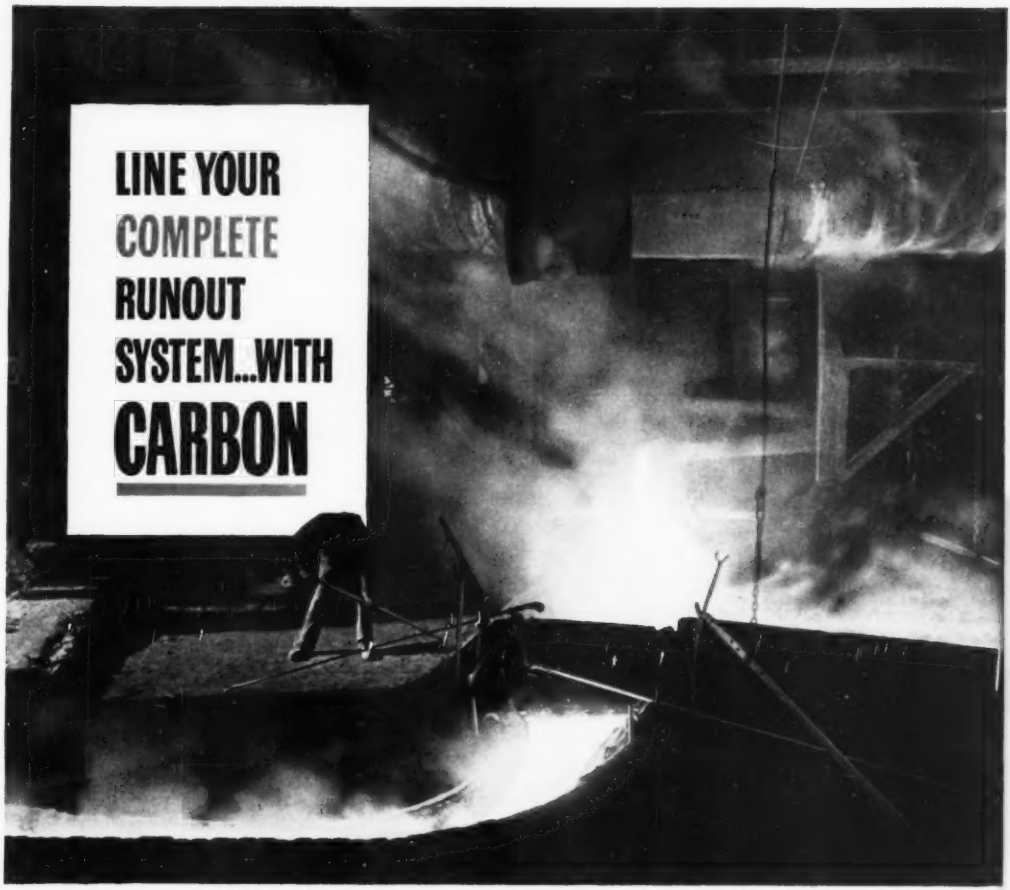



● "National" carbon-block linings have for years been doing a fine job in blast furnace runout troughs —between taphole and skimmer plate.

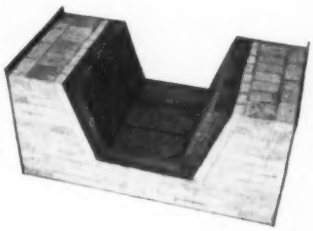
**Why stop there?**

Why not use carbon linings for the entire system, from furnace to ladle, and in the lead-in spouts of the pig machine as well? Carbon-block construction, shown at right, is recommended to the skimmer plate. Carbon bricks are most practical for the rest of the troughs.

**Why use carbon?**

Carbon outlasts other trough linings by months, even years. It is unaffected by thermal shock. Hot metal will not stick to carbon; so, if any skull is formed in the trough, it is readily removed. Furthermore, if you desulphurize in the trough, you'll find that carbon is highly resistant to desulphurizing agents.

**Here is the recommended construction for a carbon-block trough between taphole and skimmer plate. Dark section is carbon. Light section is firebrick.**



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## *cast in High Test*
# NICKEL ALLOY IRON

Crankshafts ranging from 800 to 4000 pounds in weight, and from 6 to 18 feet in length . . . for large Diesel engines in marine, locomotive, and stationary power plants . . . are now produced commercially by Pacific Car & Foundry Company's efficient new casting method.

The photograph shows an unmachined 8-throw unit that weighs 2105 pounds. It was cast in high strength nickel-molybdenum gray iron at Pacific's foundry in Renton, Washington.

This nickel alloy iron, produced as an inoculated iron in the basic electric furnace, consistently meets strength specifications of 60,000 to 75,000 p.s.i.

Each shaft is stress-relief annealed, and x-rayed to detect possible internal defects.

These nickel-molybdenum cast iron crankshafts provide:

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Avoidance of expensive dies and forging equipment, the use of cores to eliminate unnecessary metal, and the fact that castings require less machine tool time . . . point to the economy of using nickel alloy irons.

Heavy duty crankshafts indicate the wide scope of applications for high strength nickel alloy cast irons. Our casting specialists will be glad to consult with you and suggest where nickel cast irons may be useful to you. Write us today.

This high test nickel iron crankshaft is cast in a mold set horizontally, and tilted slightly while pouring. Mounted in specially designed trunions, the mold is rotated 90° to the vertical position for cooling. This provides better feeding, improved directional solidification, and thus, sound castings.

EMBLEM OF INCO SERVICE
TRADE MARK

Over the years, International Nickel has accumulated a fund of useful information on the properties, treatment, fabrication and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes, nickel silver, cupro-nickel and other alloys containing nickel. This information is yours for the asking. Write for "List A" of available publications.

**THE INTERNATIONAL NICKEL COMPANY, INC.** 67 WALL STREET NEW YORK 5, N.Y.

# NEW Foundry Products

**Readers interested in obtaining additional information on items described in New Foundry Products should send requests to Reader Service, American Foundryman, 222 W. Adams St., Chicago 6, Ill. Refer to the items by means of the convenient code numbers.**

### Variable Speed Transmission

**MR1**—Newly designed, Standard Transmission Equipment Co.'s Cub Variable Speed Transmission is especially designed for all applications where a 3.3-1 speed range and "A" section V belts are sufficient. Construction is of machined cast iron, with base dimensions 2¾ in. x 7½ in.; overall width 6½ in.; overall height 9 in. Main points of improvement over previous model is the introduction of a hardened and ground shaft rotating in a fully-sealed double ball-bearing assembly. Two outer pulley flanges are fixed to the rotating shaft, with the center pulley floating laterally on a large bronze bushing over the shaft. In the previous design, the pulleys rotated on a stationary shaft with oil-impregnated bushings as bearings. The new ball-bearinged design increases the life of the drive, and at the same time increases power output through reduction in frictional losses. Speed adjustments are made by means of lever control while The Variable Speed Transmission is in operation.

### Face Shield

**MR2**—An improved face shield that provides all-around face protection and is especially designed for metal pouring and

finishing, wood working and welding jobs is announced by the General Scientific Equipment Co. The new model has an improved headgear of extruded plastic, fitted with sweat band and pivot assembly. Visor is made of fire repellant, flexible, clear Plastacelle in three thicknesses—.020, .030 and .040 in. Also available in three shades of green—light, medium and dark in the .020 in. thickness only. All are available in 4, 6 and 8 in. depths. All visors are 11 in. wide and have reinforced wire gimp binding, that enables user to mold shield to his requirements. Visor is attached to outside of spark deflector to withstand greater impact. Distance of visor from face is adjustable.

### Densified Wood

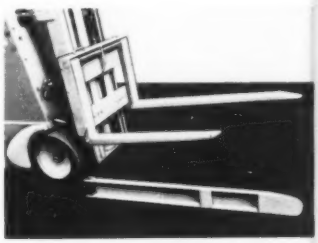
**MR3**—Hi-den, a high quality densified wood for patterns, mold and match boards and core boxes, is now being made available for industrial use by the Parkwood Co.p. Hi-Den is made from selected wood veneers, impregnated in phenolic resin and compressed under very high pressure to approximately half its original thickness. The result is a new material with such characteristics as (1) greater strength than an equal weight of any metal (2) extremely low coefficient of friction (3) high resistance to abrasion (4) high resistance to moisture (5) extreme toughness and high impact strength (6) dimensional stability (7) adaptability—can be fabricated with wood working equipment. An actively used Hi-Den pattern will last as long as aluminum and is far more economical. In large patterns, key points can be strengthened with Hi-Den insertions to take wear, keep dimensional stability and provide sharpness of pattern. A special grade of Hi-Den has been developed for match and mold boards that is heat, moisture and abrasion resistant. Such boards have been in active repeat use for as long as two years without showing signs of wear. Core boxes will likewise retain dimensional stability over an indefinite period of time, will form a low tolerance core and will withstand hard use. Hi-Den is produced and sold in 30 x 48 in. panels, ranging in thickness from ⅛ to 2 in. Where thicker sections are required, the material can be built up with resorcinol type glues and normal gluing pressures. Grade 112 is for pattern use and 212 for match and mold boards.

### Air Line Joint

**MR4**—An air line joint that directs and maintains a jet of liquid or air to any point or object in a machine operation has been developed by the Universal-Air-Line-Joint Mfg. Co. Use of this joint eliminates the frequent adjustment necessary when using makeshift pipe fitting assemblies or semi rigid tubing. Advantages are: cannot be moved by machine vibration; swivels full 360 degrees; weighs only 3½ oz; and the air-line joint's streamlined aluminum parts offer minimum obstruction to operator's view.

### Fork Extension

**MR5**—A line of slip-on fork extensions that will permit greater flexibility and adaptability for its line of power fork trucks is announced by Lewis-Shepard Products. When longer loads need to be handled, instead of changing the forks which are already mounted to the truck, a pair of the new extensions can be placed



over the forks. The welded steel extensions are available with a variety of ends; including standard ends for picking up pallets and chisel ends for handling bagged or other loose material. Extensions can be quickly and easily attached, will not raise off the fork, slip sideways or back and forth.

### Resin Adhesive

**MR6**—A resin adhesive whose function is to gear joint assembly operations to the high-speed methods of continuous flow production of wood patterns, core boxes, mold and matchboards is announced by National Adhesives. Unusually rapid setting speeds range from 15 to 35 minutes, depending upon wood specie and moisture content. Bond strength has proven excellent in laboratory tests. Wood-Lok Q3022 sets with a moisture resistant, resilient bond that will withstand extremely sharp impacts, and may be machined sawed or hammered after approximately a half hour's setting time. Wood-Lok Q3022 is ready to use as supplied, requires no cooking, heating or mixing and dries with a transparent glue line, light in color.

# FOUNDRY Literature

**Readers interested in obtaining additional information on items described in Foundry Literature should send requests to Reader Service, American Foundryman, 222 W. Adams St., Chicago 6, Ill. Refer to the items by means of the convenient code numbers.**

### Aluminum Specifications Handbook

**MR101**—A new and handy compilation of important aluminum industry specifications is claimed by its publisher, Federated Metals Division of the American Smelting & Refining Co., to be the only book of its type available. Superseding an earlier wartime version, the current edition of *"Aluminum Alloys—U.S. Standard Specifications"*, is a 24-page, full-size book and not a sales manual. This reference book is a compilation of the latest specifications of ASTM, ASM, SAE, the Federal Government and the Army and Navy, pertaining to aluminum sand castings, permanent mold castings, die castings, wrought alloys and ingots. Book is available free.

### Casting Alloys Chart

**MR102**—A chart showing specifications, chemical compositions, and physical properties of standard brass, bronze, nickel silver and aluminum castings alloys is a feature of the December, 1948, issue of *The Lavingot*, external house organ of R. Lavin & Sons, Inc., Chicago. The company announces that enlarged reprints of this chart are available upon request. The December issue of *The Lavingot* also contains an article on *"The Prehistoric Development of Metal—A Chapter in the History of Bronze"*, excerpted from the A.F.S. Publication, DEVELOPMENT OF THE METAL CASTINGS INDUSTRY, by Bruce L. Simpson. R. Lavin & Sons, Inc., has offered to place readers of AMERICAN FOUNDRYMAN on its mailing list free-of-charge, at their request and foundrymen are urged by the company to avail themselves of the opportunity to receive this interesting and informative publication regularly.

### Overhead Crane Systems

**MR103**—An unusually descriptive, fully illustrated series of catalogs has just been released by the Whiting Corp. on its Trambeam Overhead Crane and Monorail Systems. The catalogs cover general use and economy, fittings carriers, electrification, assemblies, motors drives and cranes, as well as the many applications of the Whiting Trambeam. The Trambeam is an efficient, low-cost overhead materials handling system made up of specially constructed open rails which, in the case of monorails or crane runways, are uniquely suspended by flexible connectors to the supporting structure. This flexible suspension relieves stresses, speeds up installations and makes overall operation notably easier. Trambeam systems are built in capacities ranging from 500 to 20,000 lb, and may be either hand-pushed or operated by the Whiting Vari-Pressure Drive. Catalogs available free-of-charge.

### Colorimetric Determination

**MR104**—One of a series of research papers being made available to foundryman and metallurgists by the analytical laboratory of Silverstein & Pinsof, Inc. (SIPI), is an article on *"Colorimetric Determination of Aluminum in Zinc Base Alloys"*, describing the laboratory's experiences with a study of available methods of colorimetric determination and explains the comparative merits of colorimetric procedures. Detailed information is given on tests, solutions, set-up and procedure, together with curves and a tabulation of results. A discussion of the method and a list of references are included. A copy of this paper in a handy binder is available free-of-charge.

### Industrial Truck Magazine

**MR105**—The first issue of the Hyster Company's new external company magazine, *"Lifts"*, contains articles and departments relating to materials handling with various types of industrial trucks. Feature article of the 36-page, illustrated magazine is "Industry's 8-Ball", which offers efficient materials handling as the answer to today's high cost of doing business. Another article describes the electric utilities industry and the importance of materials handling in its growth. Also included is a story on the company's history, "How Hyster Happened". General interest material, photographs and cartoons add to the magazine's attractiveness.

### Wire Sales Trainers

**MR106**—Two new pocket-size sales training booklets devoted to spring wire have recently been issued as part of the United States Steel Co.'s program designed to provide retail salesmen with the inside story on the steel used in producing household articles. Principal feature of the overall program is the preparation of 15 sales training booklets to be used in retail sales training courses throughout the United States. By the use of these booklets, four of which have already been released, salesmen are expected to be able to explain unseen qualities in the steel.

### Permanent Magnets

**MR107**—A new bulletin describing high intensity Perma-Plate Alnico Magnets for removal of harmful tramp iron from foundry sand, coal and other materials, has been issued by the Dings Magnetic Separator Co. The bulletin shows how Perma-Plate Magnets can be installed in or above wood or metal chutes, ducts, pipes, hoppers, spouts, conveyor belts and feed tables, where extraction of tramp iron is necessary for protection against product contamination, fires and explosions. Three types of magnets are shown—general duty for miscellaneous operations, heavy duty for industrial applications, and extra strong for difficult operations involving removal of large quantities of tramp iron or heavy burdens.

### Anti-Rust Paints

**MR108**—Publication of a new bulletin describing Rustrem anti-rust paint and other "Rem" paint products is announced by Speco, Inc. The bulletin lists complete instructions for the use of Rustrem, which can be applied directly over rust without wire brushing, scraping or sand blasting. According to the manufacturer, Rustrem penetrates the rust layer, renders it inactive and seals the surface against further rusting. It is suitable for spray or hand application on any metal surface and is available in black and aluminum. Other products described in the bulletin are heat-resisting aluminum paint, chemical resistant black paint and wood preservative paint.

### Drill Sizes Wall Chart

**MR109**—"Tap Drill Sizes", fourth in the South Bend Lathe Works' series of wall charts, is now available at 10 cents per copy from the South Bend Lathe Works, 91 East Madison St., South Bend, 22, Ind. Measuring 13 x 19 in., with white lettering on a blue field, the chart covers American National Screw Thread Pitches. Sizes of threads, threads per inch, outside diameter of screw, tap drill sizes and decimal equivalent of drill are given for National Coarse Standard Threads.

"I need sulpha..."

"I need penicillin..."

"I need quinine..."

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DIFFERENT FOUNDRY JOBS need *Different* Bonding Clays too!

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Another year has begun . . . We repeat our 25-year-old warning:

*Different foundry jobs demand different bonding clays,* because no one clay can do all jobs equally well.

You can't escape that fact. The requirements for hot strength, dry strength, permeability, flowability and other properties vary "all over the lot". ECP satisfies these conditions with, not one or two or three, but with *five* distinctly different bonding clays. Each has its own characteristics. Each does certain jobs best.

Here they are: Dixie Bond, Black Hills Bentonite, Revivo, Revivo Super Bond, Balanced Revivo — plus a "whole flock" of combinations. Thus equipped, ECP sales engineers can and do recommend the one right answer to your need. Thus you get most bonding strength for every dollar you spend.

* * *

*Ask for our 24-page, well illustrated bulletin describing ECP's modern and unusually complete facilities.*

**EASTERN CLAY PRODUCTS, INC.**

**Jackson, Ohio**

# *Eliminate* ASH AND FREE CARBON

with....

# DELTA PERMI-BOND*

## THE MODERN, SCIENTIFIC SEACOAL REPLACEMENT

DELTA PERMI-BOND is a specially prepared pure hydrocarbon, completely volatile at elevated temperatures. It decomposes to form a vapor-gas cushion, which is reducing in nature, and leaves only a trace (two tenths of 1% maximum) of ash.

Do not confuse DELTA PERMI-BOND with other sand additives or so-called "chemical sand-coating" cure-alls which may consist mainly of asphalt, or other petroleum by-product pitches dissolved in fuel oil or other solvents. DELTA PERMI-BOND is a scientific development protected by United States patents allowed.

*Licensed for foundry use under U. S. Patent 2256832.

## NINE IMPORTANT ADVANTAGES

1. Always uniform. Manufactured under rigid chemical and physical control.
2. Eliminates ash and free carbon which contaminate your sand.
3. Greatly reduces gas, smoke, soot and dirt in the foundry.
4. Provides correct amount of vapor gas in the mold cavity which allows use of lower permeability sand without casting blows.
5. Increases dry strength properties of sand.
6. Prevents scabbing, buckling, rat-tailing and cutting, greatly reducing scrap castings.
7. Improves casting finish . . . cuts cleaning room costs to a minimum.
8. More economical to use: cuts sand costs.
9. Much cleaner, more foolproof than seacoal.

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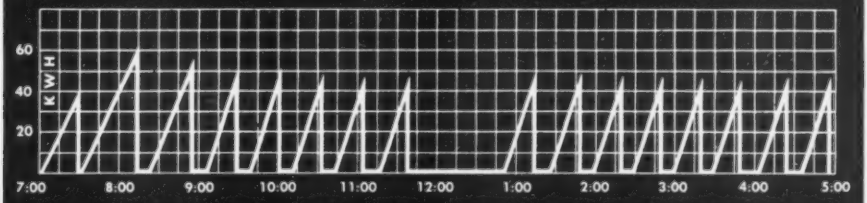


LFC—Brass

**INSTALLATION**—Three type LFC, 125 KW, 350 lb. nominal cold charge capacity Detroit Electric Furnaces in a Minnesota plumbing goods manufacturing company. Equipped with automatic rocking and electrode control.

**OPERATION**—Melt 350 lb. heats of 78% Cu, 13% Zn, 6½% Pb, 2½% Sn, and tapped into 400 lb. crucible. Operate 16 hours per day.

**COSTS—1947 Average**—Power 373 KWH/Ton—$3.53 • Electrodes, 410 lbs. bronze/lb. electrode—$ .66 Refractory, 5000 heats/lining—$ .72 • Melt loss, ¾% @ 17c/lb.—$2.60

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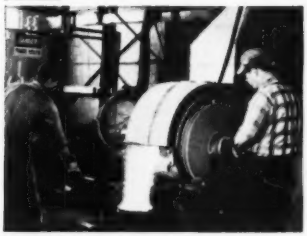
## *Equals* BETTER QUALITY + LOWER COST



● Detroit Rocking Electric Furnaces offer year-in, year-out high efficiency, uniform output, lowest possible metal shrinkage, plus constant and positive control of atmospheric conditions, accuracy of composition and speed of operation.

All-electric operation saves handling and storing of messy, bulky fuels. Indirect arc eliminates costly carbon pick-up. The arc, established clear of molten bath at all times, assures uniform melting chamber temperatures and is automatically maintained at optimum power input.

On receipt of your production data, our engineers will furnish you with complete facts on the greater economy, constant and higher quality control, and faster output you achieve with Detroit Rocking Electric Furnaces which meet your most exacting requirements. Detroit Electric Furnaces for melting ferrous or non-ferrous metals are available in 10 to 4,000 lb. capacities, with conical or cylindrical melting chambers. For complete details, write today, to

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**KUHLMAN ELECTRIC CO. • BAY CITY, MICHIGAN**

# *High Sipi I.Q.**

## *protects the quality of your castings . . .*

To begin with . . . you work with high **Ingot Quality* when you use SIPI ALLOYS. Through strict laboratory control, the correct casting qualities are assured for each type of job. This means fewer rejected castings . . . with a consequent saving in man-hours, machine-time, and materials. Our metallurgists will be glad to cooperate with you on your specific applications.

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## PERSONALITIES

*(Continued from Page 71)*

1924 and vice-president and comptroller in 1943, and has served as a director of the company since that year. In 1947, Mr. Jarchow was elected a vice-president with general executive duties. He is also a director and member of the executive committee of Griffin Wheel Co.

Two prominent Italian foundrymen, **Dr. Ing. Guido Vanzetti,** president, Vanzetti Steel Works and Foundry, Milan, and **G. Lombardi,** foundry superintendent of the Vanzetti Works, were recent visitors to A.F.S. Headquarters, Chicago. Mr. Vanzetti is president of the newly-reorganized Italian Foundrymen's Center, Milan, and was president of the International Committee of Foundry Technical Associations just before the outbreak of World War II. Mr. Vanzetti is following in the footsteps of his noted father, Carlos Vanzetti, who headed the Vanzetti Steel Works prior to his death in 1932, and who was also president of the International Committee. Messrs. Vanzetti and Lombardi are in this country inspecting modern foundry methods and for the purchase of foundry equipment for their plant.

**H. L. Creps,** vice-chairman of the Central Indiana Chapter of A.F.S., was recently transferred in his capacity as a member of the sales department of Frank Foundries Corp., from the company's Muncie, Ind., territory to Davenport, Iowa.

**Dan G. Caywood, Jr.,** of 272 Highland Ave., Newton, Mass., has been appointed exclusive representative for the George Haiss Mfg. Co., Inc., division of Pettibone-Mulliken Corp., to handle its line of conveyors and coal loaders in Maine, New Hampshire and part of Massachusetts.

### OBITUARIES

**David Prichard Hopkins,** 81, until his retirement in 1943 vice-president in charge of operations and director of the United States Pipe & Foundry Co., Burlington, N. J., died January 13 after a prolonged illness. During his 54 years of service with U. S. Pipe and Foundry, and its predecessor companies, Mr. Hopkins was active in the affairs of the American Foundrymen's Society.

**David A. Nemser,** head of the New England Technical Section of the Development and Research Division of the International Nickel Co., died January 5 at his home in West Hartford, Conn. Prior to joining Inco in 1934, Mr. Nemser was chief metallurgist of Pratt & Whitney Division, Niles-Bement-Pond Corp., Hartford. He was a graduate of the Carnegie Institute of Technology in 1919.

**Jeffrey M. Taylor,** 70, secretary-treasurer of the National Foundry Association since 1912 and an official of that organization since 1903, died February 15 in Oak Park, Ill. A graduate of Northwestern University, Mr. Taylor was a member of the Chicago Bar Association, and well-known as a labor attorney.

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Available both as a floor-mounted type (shown) or an overhead installation. Complete with a motor-driven sludge removal convevor, where required.

AUTOMATIC ELIMINATION
from Collection to Disposal

Operators of modern foundries have long since learned the economy of ridding their shops of destructive dust and smoke fumes. Men who work in foundries free of these health hazards feel better, work better, produce more. And the accident rate is lowered. In actual foundry operation, the Schmieg CENTRI-MERGE method of dust and fume elimination has shown marked advantages over any other system. Dust and fumes are collected *immediately they occur*—shot back on a stream of air through ducts to the Collection Unit. In the washing chamber of this unit—a veritable tornado of seething, churning water-dust is washed and scrubbed from the air and flooded into the sludge tank below, permanently trapped under water. Fumes go out the exhaust. AUTOMATIC operation from start to finish.

If you are interested in learning why the CENTRI-MERGE method is so highly endorsed by foundry owners and how its application can so greatly benefit your own operation, our engineers are prepared to give you some eye-opening information on dust and fume elimination—without obligation, of course.

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Engineers & Manufacturers

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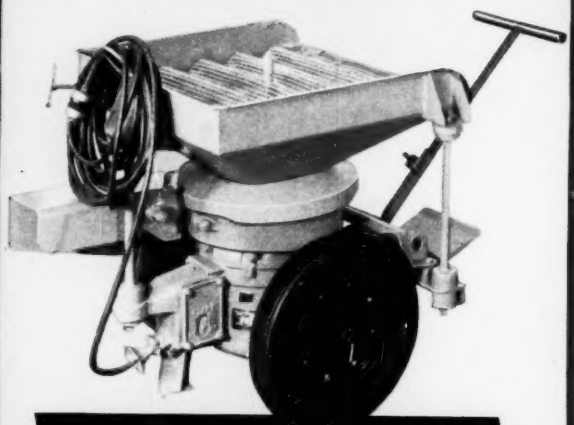
*...another Better Method by*

# BEARDSLEY & PIPER



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## CHAPTER ACTIVITIES

*(Continued from Page 76)*

Erie, Pa., led a prolonged discussion on foundry finishing problems. He pointed out that inspection and finishing costs are dictated to a large extent by prior steps in the manufacture of the casting, including the blueprint stage. Gating methods will have an important bearing on the amount of finishing required, and for the same reason fins should be eliminated from the casting whenever possible. Recommended procedures in grinding, shearing, milling, pressing, coining, and hand straightening also were discussed in detail.

Richard Senz, Permanent Mold Division, Aluminum Co. of America, Cleveland, discussed *"Metallurgical Inspection of Castings."* He stated that chemical, mechanical and physical property determinations are employed in this type of inspection, and the tests usually are divided into two classifications, destructive and non-destructive. He discussed specific tests in both these general fields of testing.

Patternmakers held a panel discussion on the subject, *"Should Metal Patterns Be Machined or Hand Cleaned?"* F. C. Cech, instructor, Cleveland Trade School, Cleveland, was panel chairman. Members of the panel included Ed Glossner, president, Modern Pattern Works; Tom West, superintendent, West Steel Castings Co.; Charles Wilberschied, superintendent, Master Pattern Co., and George Wright, pattern buyer, John Harsch Bronze Foundry Co., Cleveland.

The audience concurred in the general opinion expressed by panel members that machined patterns form the basis for a standard by which castings can be judged. Identical, machined patterns cannot be blamed for defective work. If one foundry can turn out work with a pattern, then another foundry ought to be able to produce acceptable castings with an identical pattern.

### Central Michigan

A. J. Stone
Albion Malleable Iron Co.
Chapter Reporter

"General Foundry Practice" was the subject of an address given by W. M. Ball, R. Lavin & Sons, Inc., Chicago, at the January 18

meeting of the chapter, held at the Columbus Hotel, Kalamazoo. Mr. Ball outlined the most recent developments in foundry practice in both the ferrous and non-ferrous founding fields.

Despite the hazardous driving weather, all sections of the chapter district were well represented.

### Northwestern Pennsylvania

James J. Farina
American Sterilizer Co.
Chapter Reporter

"WET CLEANING OF CASTINGS" was the technical address of the evening at the January 24 meeting, held at the Moose Club, Erie. The speaker, N. Ransohoff, president of N. Ransohoff, Inc., Cincinnati, emphasized the additions of chemicals to water to impart rust-resistant qualities to castings. Following Mr. Ransohoff's address, Clyde E. Cooper, Keystone Brass Works, Erie, led the question and answer period.

Dr. Herman C. Grose, Superintendent of Schools, Erie, was the coffee talk speaker. Dr. Grose discussed vocational training in public schools, calling attention to the need for new vocational schools which would better train boys for Erie industry. Joseph A. Shuffstall, National Erie Co., led the discussion period following.

### Ontario

Alvin E. Bock
A. E. Bock Foundry Co.
Chapter Reporter

A JOINT MEETING of the Chapter Directors and the Educational Committee was held at Hamilton, January 19, under the chairmanship of Russel A. Woods, Geo F. Pettinos Co. Many chapter items were dealt with, but the main item was a report by R. H. Williams, Canadian Westinghouse Co., Hamilton, Educational Committee chairman, on the recent purchase of 14 sound films dealing with foundry practice, a sound projector and a film strip projector.

These films are to be made available to foundries and community groups to further foundry education and training. After a discussion of methods of handling rental and showing of the films, it was decided to charge $35 on the entire group, or $3 per film, and Mr. Williams will be in charge of distribution and scheduling of the films. All members of the Ontario Chapter will shortly receive complete details on the films by mail.

### Tennessee

Carl A. Fischer, Jr.
Fischer Supply Co.
Chapter Reporter

WAYS OF CONSERVING FOUNDRY COKE supplies were outlined by J. A. Bowers, superintendent of the American Cast Iron Pipe Co., speaking on *"Foundry Coke"* before the January 21 meeting, held at the Hotel Patten, Chattanooga and attended by more than 80 members and their guests.

Chapter Vice-Chairman K. L. Landgrebe, The Wheland Co., presided, and Charles Saunders, Tennessee Products & Chemical Corp., introduced the speaker.

The speaker said that some 20 years ago, Dr. J. T. MacKenzie of the American Cast Iron Pipe Co., showed that the temperature and carbon content of iron depend on the purity and structure of the coke used to melt it.

In doing research work on the effect of coke size, Mr. Bowers said, it was found that carbon and sulphur decrease as coke size is increased. Maximum spout temperatures were reached at any intermediate size. This leads to the conclusion that there is an optimum coke size for each size cupola and/or different operation, Mr. Bowers said.

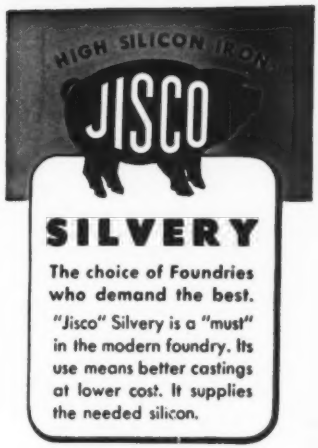
About seven years ago, according to the speaker, in experimenting with self-fluxing coke, lime was included in coal mix before coking—the resultant coke contained approximately 10 per cent lime as compared to about 2.5 per cent in ordinary coke. The experiment was discontinued because of the war but showed promise.

Experimental heats to determine the value of bottom coke showed this coke had no different effect on the metalloids during melting, and Mr. Bowers' company has been using it in place of new coke since that time.

Tests were made as to the use of wet coke vs. dry coke, and it was found that wet coke performed more satisfactorily.

Every possible means must be found to conserve foundry coke, Mr. Bowers said, and pointed out that some of the means to this end are supervision by persons under-

*(Continued on Page 91)*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The choice of Foundries who demand the best.
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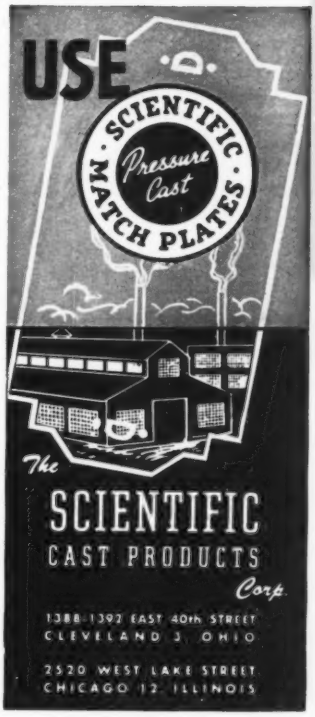
JACKSON, OHIO



# FOUNDRY FIRM Facts

**Lebanon Steel Foundry,** Lebanon, Pa., announces that its $500,000 plant expansion program for the production of superalloy castings under secret processes developed by **Firth-Vickers Stainless Steels, Ltd.,** Sheffield, England, has been completed. The new plant addition and equipment installations are expected to double the company's high-alloy steel casting facilities. Holder of an exclusive American license from Firth-Vickers, Ltd., Lebanon Steel Foundry is utilizing the process for the production of castings for warplane jet engines, and adaptations for other military and industrial requirements are under way. Features of the new plant are two five-ton overhead traveling cranes, two new electric induction furnaces, two rotary cold saws, and five centrifugal casting machines. Built to Lebanon's order by the Centrifugal Casting Machine Co. of Tulsa, Okla., these machines incorporate a number of design innovations. Three are of the vertical type and two are of the horizontal type. Together, the five machines are designed to cover all phases of Centri-Die Casting requirements arising in diversified foundry practice.

**Michigan Oven Co.,** Detroit, was recently incorporated under the laws of Michigan for the purpose of designing, fabricating and distributing industrial ovens of all types for operating temperatures to 1103F. Officers of the new company, for many years prominent in the industrial oven field, are former employees of Young Brothers Co. They are: president, R. J. Ruff; vice-president, E. C. Herrington; and secretary, P. A. Meyer. Sales representatives already appointed have a cumulative service of over 150 years in the development and distribution of industrial ovens. The company's home office will be located at 4541 Grand River Ave., Detroit, 8, Mich. Complete design, fabrication, erection and service facilities are available.

**Claud S. Gordon Co.,** Chicago, has completed the building of its new Cleveland branch plant at 2035 Hamilton Ave., Cleveland, 14. Cleveland manufacturing operations, as well as the local sales office, have been transferred to the new and larger plant, which includes a complete modern service laboratory and equipment showroom. E. W. Romig, company vice-president and general manager, is in charge of the new branch plant.

**Belle City Malleable Iron Co.** and **Racine Steel Casting Co.,** Racine, Wis., were recently recipients of an award for employer-employee communications from *The Score*, national publication on personnel relations. The citation was made "for the best single plant bulletin board program". Belle City's bulletin board contains pictures, news, safety programs, employee service anniversary recognition, sports and recreational activities news, and a castings products recognition series.

**Salem Engineering Co., Ltd.'s** offices for England and the British Empire were recently moved from Sheffield to Milford House, Milford, near Derby, England. The change of location has been made because of the removal of engineering and manufacturing facilities to that area. The company is the British subsidiary of the **Salem Engineering Co.,** Salem, Ohio.

**Westover Engineers,** Milwaukee foundry management consultants, announces purchase of the **Nelson Foundry Co.,** Milwaukee non-ferrous foundry. The plant will be used by Westover as a laboratory for foundry research work, for training of personnel in cost work, and as an example of how small foundries can reduce cost work to a minimum. Commercial jobbing work will be undertaken to keep the unit in operation, and will be sold on a basis of individual cost estimates.

**Atwood Precision Casting Corp.,** Brooklyn, N. Y., recently purchased the precision casting facilities of **Precise Castings Corp.,** Hillside, N. J., a division of Cooper Alloy Foundry Co. The acquisition is expected to double Atwood's precision cast steel output, and will result in a 25 per cent overall increase in total casting potential. Purchase of the additional facilities was made in order to overcome a large backlog of orders and to shorten delivery date on current and future production.

**Klinger-Dills Co.,** Dayton, Ohio, has been appointed exclusive distributor for the Belting Division of the Russell Mfg. Co., Middletown, Conn., makers of conveyor and transmission belting and endless, high-speed belts.

*Jackson Iron and Steel Co., Jackson, Ohio, recently played host to this group of metallurgy students from Ohio University, Athens, Ohio. The students, in charge of Prof. L. V. Calvin (extreme left) and Dean E. J. Taylor (fourth from left), were conducted among the plant by Jisco's metallurgist, Wilfred H. White. The group saw ore stockpiles, the air conditioner which delivers almost a ton of dry air per minute, stoves which utilize waste gases from the top of the blast furnace to heat the air to about 1500 F, and the blast furnace itself in operation. The visit was timed to enable the students to see a flush of slag, as well as a cast of silvery pig iron from the furnace.*

## CHAPTER ACTIVITIES

*(Continued from Page 89)*

standing melting procedure, alert control of temperature, slag and melting speeds, good coke bed, avoidance of dull iron at beginning of heat, excessive scrap or pigged metal, too low or too high a bed.

It is important that the cupola be charged evenly, Mr. Bowers continued, and materials for metal charges must be carefully selected. The operator should know the maximum weight of the iron charge for each cupola, and must endeavor to keep a balance between air into tuyeres and coke.

Temperatures on ladles can be saved by insulating and preheating, and large amounts of drop coke can be saved if quenched quickly. Wetting coke before charging and preheating the blast is a sure way to save coke, Mr. Bowers said and recommended that tuyeres be kept clean and bright during the whole melting period.

### British Columbia

Norman Terry
Canadian Sumner Iron Works, Ltd.
Chapter Secretary-Treasurer

MECHANIZATION OF FOUNDRY OPERATIONS in British Columbia was urged by A. W. Gregg, executive engineer, Whiting Corp., Harvey, Ill., speaking at the January 18 meeting, held in the Medical-Dental Auditorium, Vancouver. Mr. Gregg stated that mechanization of British Columbia foundries would (1) reduce operating costs (2) produce higher quality castings (3) increase foundry production, and (4) attract a better class of employee to the foundry industry.

One of the major problems in the foundry industry, the speaker said, is that of materials handling. Second to materials handling are metallurgical problems, he added.

The foundry industry is ready for a large-scale clean-up program that will create better working conditions and attract a better type of employee to the industry, Mr. Gregg said. He suggested a formula for working out an amortization program for the mechanization of a foundry. For example, he said, 50 per cent of the saving which would result from installation of mechanical molding facilities could be passed on to the customer by means of lower-priced castings; 10 per

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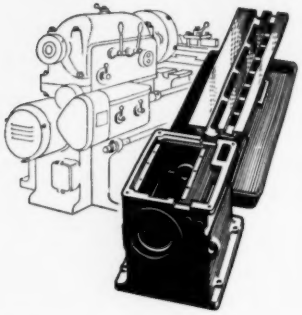

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cent could be set aside for depreciation reserves; 20 per cent could be allocated to the company; and the balance of 20 per cent passed on to the employees in the form of piece rates or bonus plans. In conclusion, Mr. Gregg stated that many mechanical devices installed in foundries pay for themselves in operational savings in less than five years.

Following A. W. Gregg's talk, his cousin, A.F.S. National Director Robert Gregg, Reliance Regulator Corp., Alhambra, Calif., spoke on the principles and policies of the American Foundrymen's Society, and reported on his personal observations of mechanical foundry operations in the United States and Canada, as compared with those of Europe he visited last summer.

### Ohio State University

Harold J. Gonya
Chapter Vice-Chairman

NEWLY-ELECTED OFFICERS of the Ohio State University Student Chapter are Vice-Chairman Harold J. Gonya, who is acting chapter chairman because of the graduation of Chairman Thomas Dole, and Secretary-Treasurer Arthur Stoner.

Many speakers from industry have addressed the chapter during the first year of its existence. The chapter, now numbering 40 men, recently created a publicity committee for the purpose of making the chapter a "known" organization on the campus, a move that will help to induce engineering students to join the foundry group. It is interesting to note that students other than those taking foundry courses attend chapter meetings to hear the speakers.

Although the Ohio State University Student Chapter is only a year old, its members feel that it is already getting a good name among foundrymen because of the "ambassadors" it has sent forth.

### Michiana

S. F. Krzeszewski
American Wheelabrator & Equipment Corp.
Chapter Reporter

NINETY-FIVE MEMBERS attended the January dinner meeting held in the Hotel LaSalle, South Bend, Ind., January 6. Wm. B. McFerrin, metallurgical engineer of the Electro-Metallurgical Sales Co., Detroit, was the guest speaker of the evening. Speaking on *"Casting Defects"*, Mr. McFerrin stated, "Because of a change from a seller's to a buyer's market, foundries in general will need to observe production results more carefully and inaugurate a better control over scrap."

Citing an annual output of 15 million tons in the foundry industry, the speaker informed his audience that if scrap was reduced only 1 per cent in general, the output of good castings would increase by 150,000 tons—bringing in additional revenue of $30 million to the industry, the speaker said.

Mr. McFerrin further outlined a properly organized approach to the solution of scrap problems. This plan incorporates calling in all persons concerned with the production of castings, to view defects with unbiased minds. The analysis should determine whether the defective castings were caused by failure of management to properly evaluate the type of casting to be produced, failure to provide proper equipment, failure to understand how to produce the casting, failure to have casting designed properly or failure to select men properly for production of casting.

Ralph Stickley, of the Oliver Corp., South Bend, Ind., and Harry Hunt, Auto-Specialties Co., of St. Joseph, Mich., were presented to the chapter as new members.

Wm. Ferrell, works manager, Auto-Specialties Co., presented Mr. McFerrin as guest speaker. K. A. Nelson, works manager, Chicago Hardware Co., Elkhart, Ind. chairman of the chapter, presided.

## HACKLEY SCHOOL

*(Continued from Page 31)*

Members of the Western Michigan Chapter's Advisory Committees to the Hackley Manual Training High School are:

*Advisory-Contact:* W. A. Hallberg, Lakey Foundry & Machine Co.; H. C. Bement, CWC Foundry Co.; G. W. Myers, West Michigan Steel Foundry; W. G. Grant P. M. Wiener Foundry Co. *Foundry General:* W. G. Grant; Roy Herbst, West Michigan Steel Foundry; P. D. Baldwin, Lakey Foundry & Machine Co.; E. C. Bumke, CWC Foundry Co.

*Sand, Mixing & Testing:* C. H. Cousineau, Lakey Foundry & Machine Co.; S. H. Davis, CWC Foundry Co.; E. W. Olsen, Dake

## HACKLEY SCHOOL

Engine Co. *Core Making:* George Tarr, Lakey Foundry & Machine Co.; F. Galoit, West Michigan Steel Foundry.; G. R. Richardson, CWC Foundry Co.

*Molding:* Charles Pierce, West Michigan Steel Foundry; E. H. Albrecht, P. M. Wiener Foundry Co.; A. Larsen, Enterprise Brass Works. *Patterns:* A. J. Kohlbeck, Monarch Pattern & Engineering Co.; W. G. Forsberg, CWC Foundry Co.; A. W. Thompson, Lakey Foundry & Machine Co.; C. N. Damm, Pyle Pattern & Mfg. Co.

*Melting and Pouring:* H. C. Bement, CWC Foundry Co.; Rudolph Flora; Clover Foundry Co.; M. A. Amos, Standard Auto. *Cleaning, Grinding, Shotblasting:* A. F. Jeannot, West Michigan Steel Foundry; L. O. Taylor and V. L. Robertson, CWC Foundry Co.

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*Inspection:* Guy Little, CWC Foundry Co.; V. Jeannot, West Michigan Steel Foundry; R. L. Leistiko, Lakey Foundry & Machine Co. *Equipment, Electrical:* H. L. Barbour, CWC Foundry Co.; J. H. Stevens, Lakey Foundry & Machine Co.; P. Peterson, West Michigan Steel Foundry.

*Equipment, Mechanical:* E. C. Young, Sealed Power Corp.; E. Figge, P. M. Wiener Foundry Co.; E. W. Beach, CWC Foundry Co.; C. N. Jacobson, Dake Engine Co.

*Purchasing:* W. G. Hayes, CWC Foundry Co.; A. E. Maier, Lakey Foundry & Machine Co.; S. A. Vanderlaan, West Michigan Steel Foundry.

*Laboratory Chemical:* L. Harper, CWC Foundry Co.; A. J. Casadonte, Casadonte Laboratories; C. E. Wheaton, Sealed Power Corp. *Physical:* Fred DeHudy, Centrifugal Foundry Co.; R. T. Schaffer, Lakey Foundry & Machine Co.; V. A. Lenar, CWC Foundry Co.

*X-Ray:* S. H. Davis, CWC Foundry Co.; F. Pengilley, Sealed Power Corp. *Spectrographic:* A. M. Sampson, CWC Foundry Co. *Time Standards:* L. Horstman, Lakey Foundry & Machine Co.; L. O. Taylor, CWC Foundry Co.

*Educational and Publicity:* C. J. Lonnee, Clover Foundry Co.; H. Workman, CWC Foundry Co.; W. Brooks, Sealed Power Corp.


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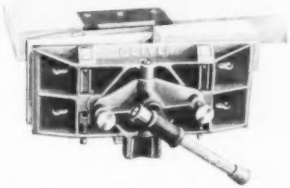

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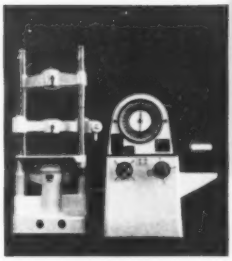

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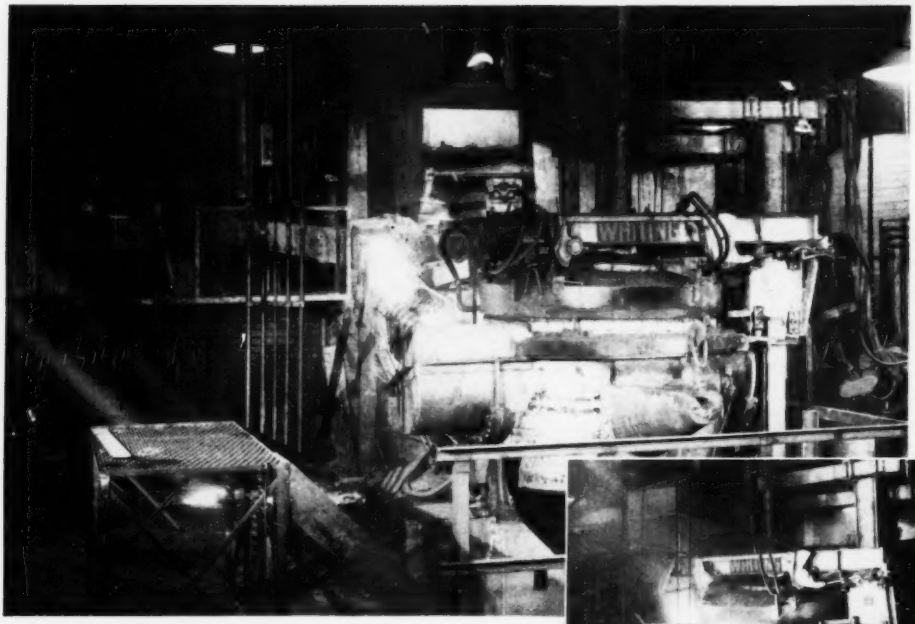

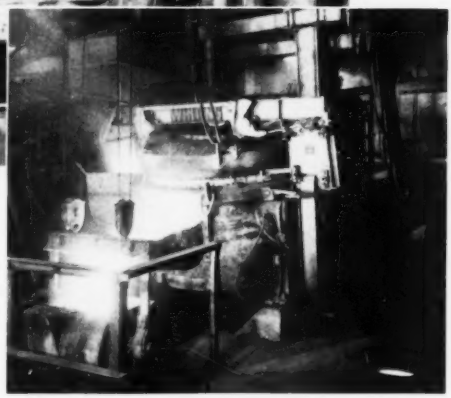

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*Offices in Chicago, Cincinnati, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, and St. Louis. Agents in other principal cities. Canadian Subsidiary: Whiting Corporation (Canada) Ltd., Toronto, Ontario. Export Department: 30 Church St., New York 7, N. Y.*